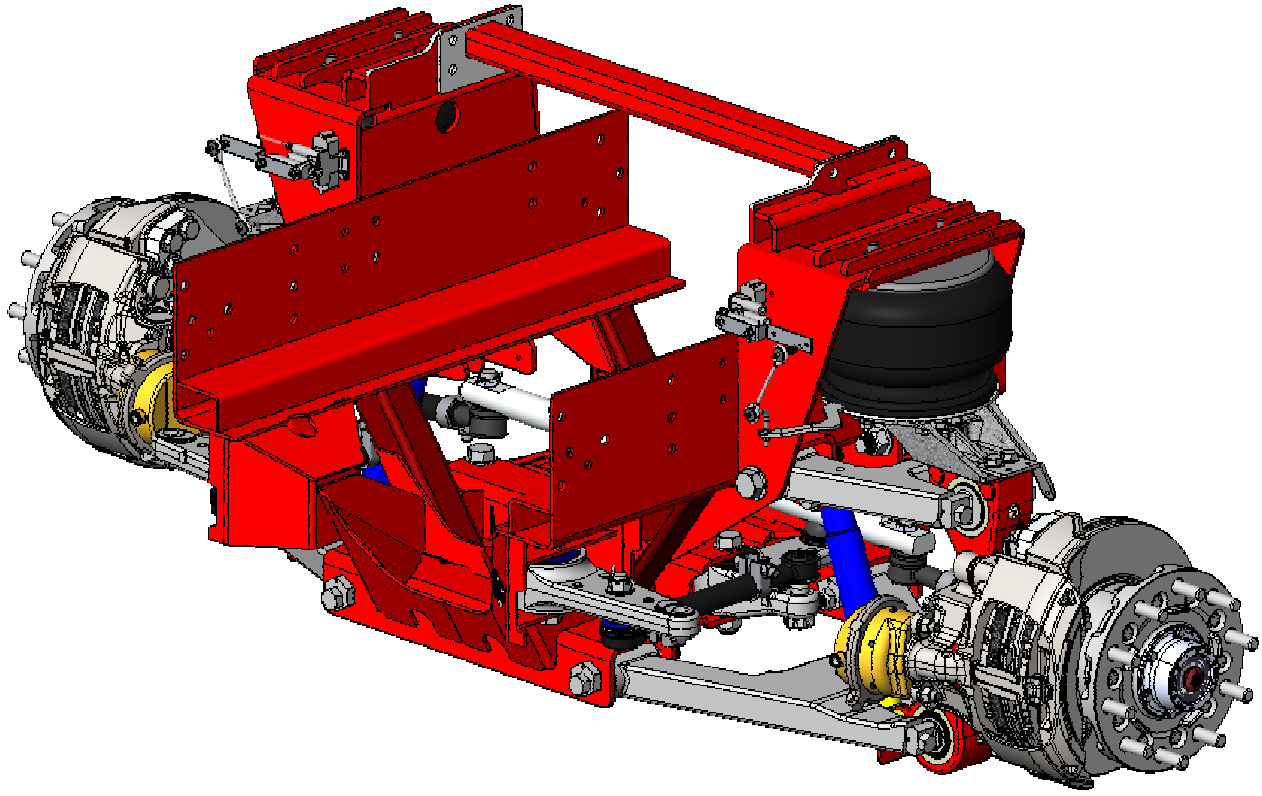
Reyco® Granning®
SUSPENSIONS

1660/1800FT INDEPENDENT FRONT SUSPENSION SERVICE MANUAL



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Introduction

Service Notes

This Service Manual describes the correct service and repair procedures for the ReycoGranning® IFS1660 Independent Front Suspension model with 16,600 lbs., and the IFS1800FT Independent Front Suspension Model with 18,000 lbs. Gross Axle Weight Rating (GAWR). Overloading the suspension may result in adverse ride and handling characteristics.

You must read and understand all procedures and safety precautions presented in this manual before conducting any service work on the suspension.

Proper tools must be used to perform the maintenance and repair procedures in this manual. Some procedures require the use of special tools for safe and correct service. Failure to use the proper and/or special tools when required can cause personal injury and/or damage to suspension components.

You must follow your company safety procedures and use proper safety equipment when you service or repair the suspension.

The information contained in this manual was current at the time of printing and is subject to change without notice or liability. Tuthill Transport Technologies reserves the right to modify the suspension and/or procedures and to change specifications at any time without notice and without incurring obligation.

Tuthill Transport Technologies uses the following types of notices for potential safety problems and to give information that will prevent damage to equipment.

⚠ WARNING
A warning indicates procedures that must be followed exactly. Serious personal injury can occur if the procedure is not followed.

⚠ CAUTION
A caution indicates procedures that must be followed exactly. Damage to equipment or suspension components and personal injury can occur if the procedure is not followed.

NOTE
A note indicates an operation, procedure or instruction that is important for correct service.

Identification

The suspension model and serial number are stamped on an aluminum tag that is riveted to the front of the suspension subframe assembly (Figure 1). The serial number is used by Tuthill Transport Technologies for control purposes and should be referred to when servicing the suspension or requesting technical support (Figure 2).

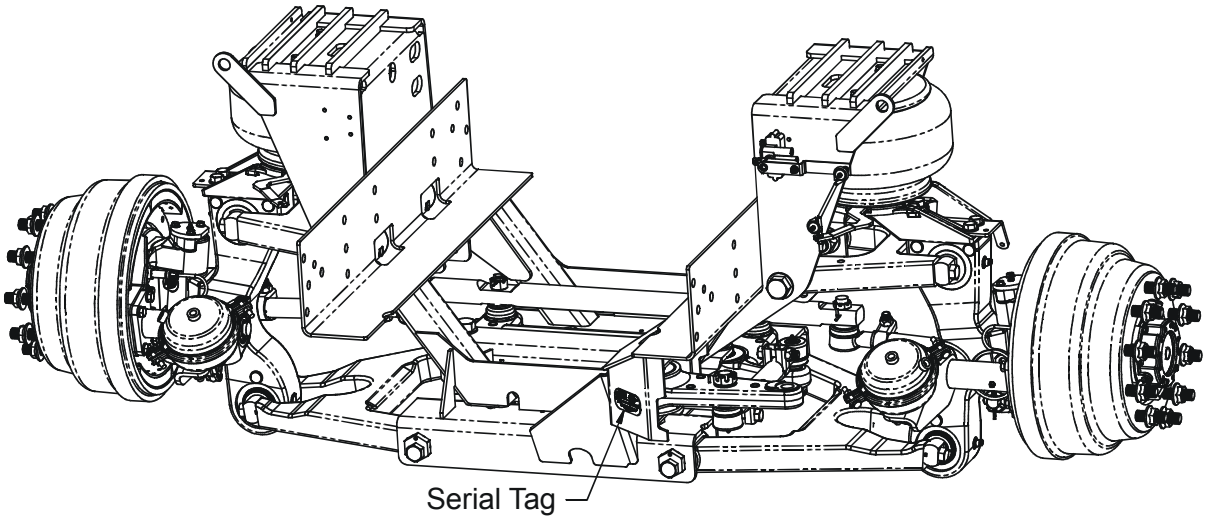


Figure 1- Suspension Identification Location

Figure 2 - Suspension Serial Number Tag

Model	GAWR	Wheel Cut	Sway Bar	Disc Brakes	Drum Brakes
IFS1660S	16,600 lbs.	55°		X	
IFS1660S-SB	16,600 lbs.	55°	X	X	
IFS1800S-FT	17,000 lbs.	55°		X	
IFS1800S-FTSB	17,000 lbs	55°	X	X	

Model Identification Table

Vehicle Towing Information

If a vehicle is disabled and needs to be towed by the front end to service center, check the OEM/Coach Builder towing procedures for the recommended method. Check with local authorities and Department of Transportation (DOT) for permissible towing methods before towing. Some states do not permit towing by chains and/or straps.

The preferred towing apparatus is the type that cradles the front tires. If the towing apparatus cannot be attached to the front tires or directly to the chassis frame rails, then the suspension subframe may be used for attachment.

⚠ WARNING

Attaching towing equipment to improper locations and failure to utilize OEM/Coach Builder recommended towing methods could result in one or more of the following:

- **Loss of vehicle control.**
- **Possible disconnection from tow vehicle.**
- **Damage to the suspension and/or vehicle.**

Do Not attach tow apparatus (hooks, chains, straps, etc.) to suspension upper and lower control arms, sway bar and brackets, brake components, tie rods, steering arms, or steering knuckle carrier assemblies (Figure 3).

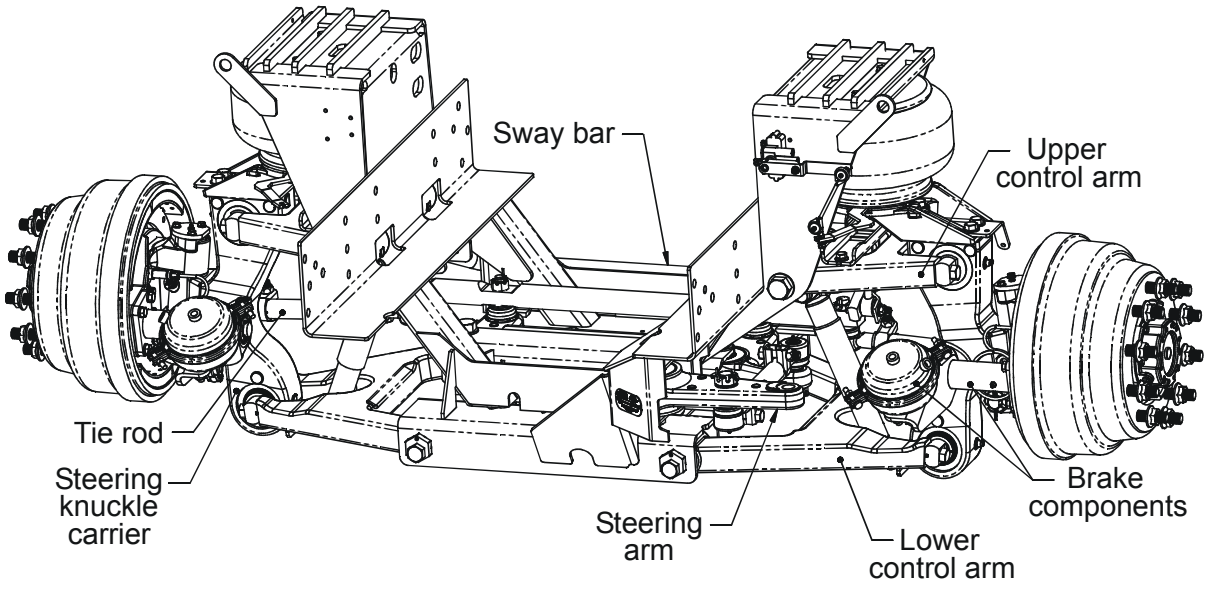


Figure 3 – **Improper** Tow Equipment Attachment Locations

Maintenance Schedule

GENERAL MAINTENANCE	SERVICE TO BE PERFORMED	MILEAGE IN THOUSANDS							
		12	24	36	48	60	72	84	96
Steering Arm Ball Joints	Check axial endplay.				X				X[2]
	Inspect for ruptured seals.	X	X	X	X	X	X	X	X[2]
	Check that cotter pin is installed.	X	X	X	X	X	X	X	X[2]
Control Arm Bushings	Check bolt torque.				X				X[2]
	Inspect for contact between control arm and mount.	X	X	X	X	X	X	X	X[2]
	Inspect for bushing wear.	X	X	X	X	X	X	X	X[2]
Tie Rod Ends	Inspect ball socket endplay.	X	X	X	X	X	X	X	X[2]
	Check for looseness of taper connection.	X	X	X	X	X	X	X	X[2]
	Check that cotter pin is installed.	X	X	X	X	X	X	X	X[2]
Brake System	Inspect slack adjuster for correct stroke.	X	X	X	X	X	X	X	X[2]
	Inspect for air leaks using soapy water solution.	X							
Air Springs	Inspect for proper clearance (1” minimum all around).	X							
	Check upper mount nut and lower mount bolt torque.	X							
	Inspect for signs of chafing or wear.	X	X	X	X	X	X	X	X[2]
	Inspect for air leaks using soapy water solution.	X							
Height Control Valve and Linkage	Inspect for signs of bending, binding, or slippage.	X	X	X	X	X	X	X	X[2]
	Inspect for air leaks using soapy water solution.	X							
Shock Absorbers	Check mounting nut torque.	X							
	Inspect shocks for signs of fluid leak, broken eye ends, loose fasteners, or worn bushings.	X	X	X	X	X	X	X	X[2]
Kingpins	Check for wear.				X				X[2]
	Inspect vertical endplay.				X				X[2]
Steering Arm Bearings	Check nut torque.				X				X[2]
	Inspect bearings for excessive radial play.	X	X	X	X	X	X	X	X[2]
Carrier Bearings	Check axial endplay.								X[2]
Wheels	Check bearing endplay.				X				X[2]
	Check wheel nut torque[1].	X	X	X	X	X	X	X	X[2]
Front Alignment	Inspect toe-in[3].		X		X		X		X[2]
Air Fittings and Air Lines	Inspect for air leaks using soapy water solution.	X							
	Inspect for signs of chafing, cracking, or wear.	X	X	X	X	X	X	X	X[2]
Sway Bar Bushings	Check mounting bolt torque.				X				X[2]
	Inspect for bushing wear.	X	X	X	X	X	X	X	X[2]

1. Wheel nuts must be re-tightened to proper torque specifications as per the vehicle or chassis manufacturer’s Owner Guide.
2. Continue to perform specified maintenance every 12,000 miles or at previous interval.
3. Final stage manufacturer should complete toe-in inspection and adjustment after completion of vehicle.

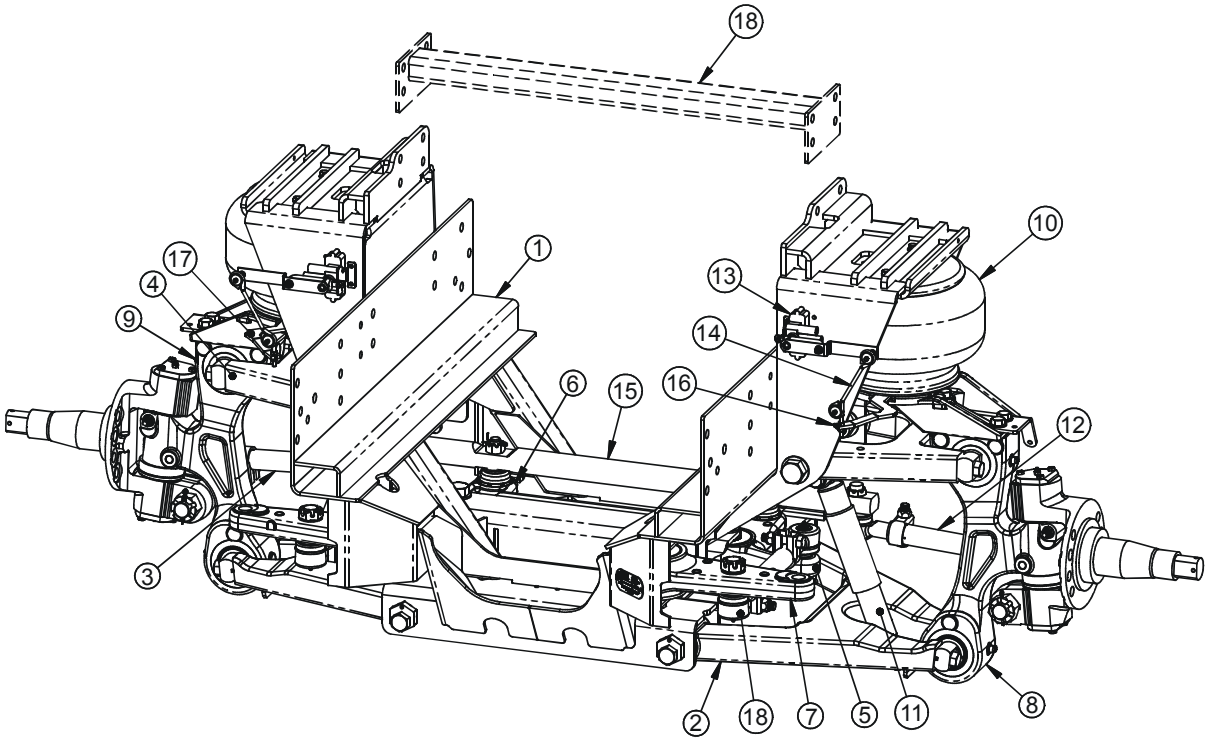
Maintenance Record

Name of Owner			Address of Owner
Date of Purchase	Name and Address of Dealer		
Model of Vehicle	Vehicle Identification Number		
Suspension Model Number: **IFS1660S; IFS1660S-SB; IFS1800S-FT; IFS1800S-FTSB**	Suspension Serial Number:		
Inspection and Maintenance Item	Date	Mileage	Service Performed

Unit Assembly

Item	Part No.	Description	Item	Part No.	Description
1	701900-01	Sub frame Assembly*	10	705951-01	Air Spring Assembly
	703117-01	Sub frame Assembly**		706841-01	Air Spring Assembly***
	706022-01	Sub frame Assembly***	11	700178-06	Shock Absorber
2	700944-01	Lower Control Arm Assembly	12	700973-01	Tie Rod Assembly, LH
3	700973-02	Tie Rod Assembly, RH	13	5608	HCV Assembly
4	703182-01	Upper Control Arm Assembly	14	703915-01	HCV Linkage Assembly
5	705619-01	Bell Crank Assembly, LH	15	702030-01	Relay Rod
6	705620-01	Idler Arm Assembly	16	705800-01	Height Control Valve Arm, LH
	705619-02	Bell Crank Assembly, RH	17	705800-02	Height Control Valve Arm, RH
7	701924-01	Crank Arm Assembly	18	700973-04	Crank Arm Link Assembly
8	705633-01	Carrier Assembly, LH	19	705573-01	Crossmember ***
9	705633-02	Carrier Assembly, RH			

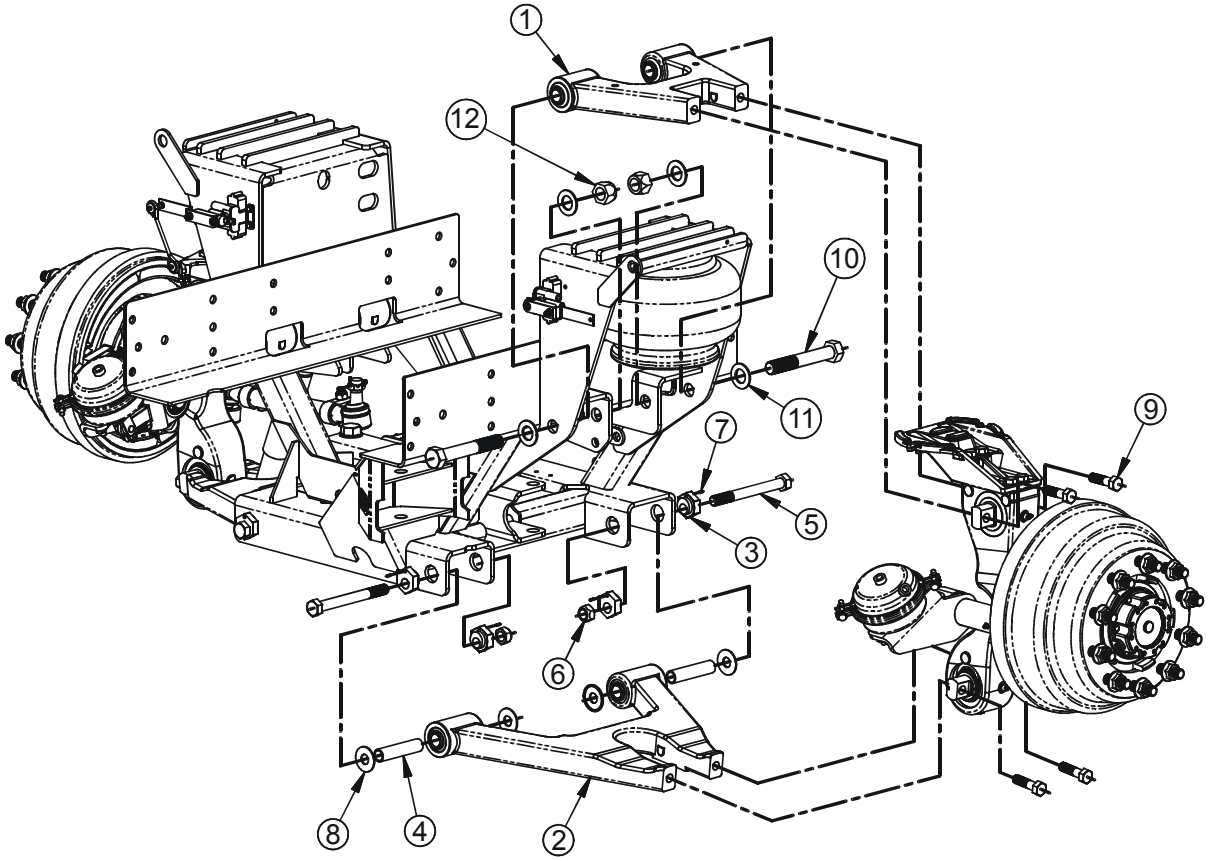
*Used with IFS1660S Units
**Used with IFS1660S-SB Units
***Used with IFS1800FT Units



Control Arm Components

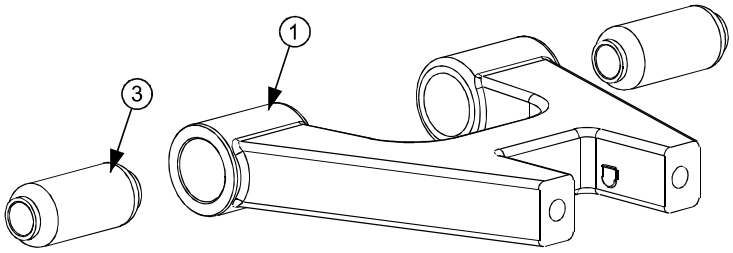
Item	Part No.	Description	Item	Part No.	Description
1	703182-01	Assembly, Upper Control Arm	8	701683-04	Hardened Flat Washer, 7/8”
2	700944-01	Assembly, Lower Control Arm	9	100039-P1	Hex Head Bolt 3/4-10 x 2.75, Gr. 8, Zn
3	700245-01	Boss, Eccentric		706263-01	Hex Head Bolt 3/4-10 x 2.75, Gr. 9, Zn**
4	8490	Spacer	10	702516-02	Hex Head Bolt 1 1/8-12 x 7.75, Gr. 8, ZY
5	292	Hex Head Bolt 7/8-9 x 8.50, Gr. 8, ZN	11	168	Hardened Flat Washer, 1 1/8”
6	100122-P1	Lock Nut 7/8-9”, Gr. C	12	166	Lock Nut 1 1/8-12, Gr. C
7	293	Socket Set Screw 10-24 x .38”			

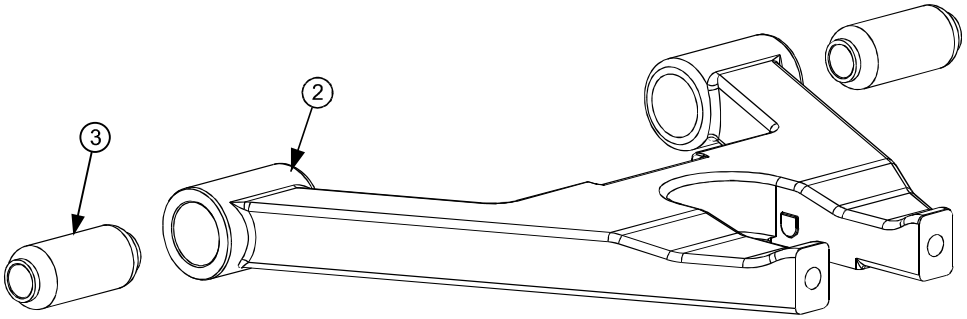
**Used with IFS1800FT Units



Control Arm Assemblies

Item	Part No.	Description	Item	Part No.	Description
1	703181-01	Upper Control Arm, LH & RH	3	8382	Bushing
2	700939-01	Lower Control Arm, LH & RH			

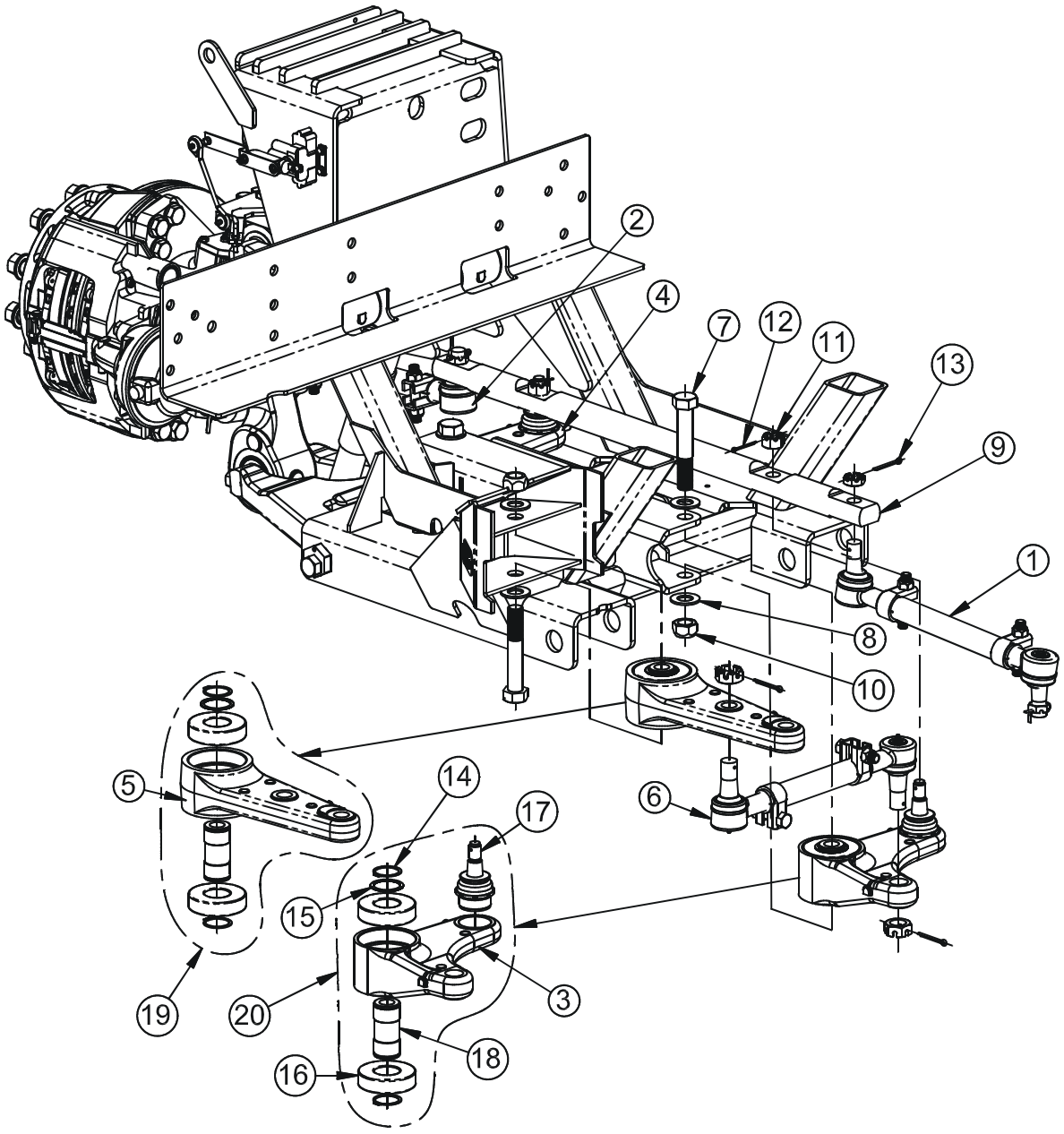




Steering Components (IFS1660)

Item	Part No.	Description	Item	Part No.	Description
1	700973-01	Tie Rod Assembly, LH	**11	705382-02	Slotted Nut, M20x1.5
2	700973-02	Tie Rod Assembly, RH	**12	705382-03	Cotter Pin, 1.40 x .15 Dia.
3	700975-01	Bell Crank	13	101445-P1	Cotter Pin- 1/8 X 1 1/2
4	705620-01	Idler Arm Assembly	*14	6966	Snap Ring
5	701925-01	Crank Arm	*15	8654	Shim
6	700973-04	Crank Rod Assembly	*16	701378-01	Bearing
7	167	Hex Head Bolt 1-14 x 6", Gr. 8	**17	705382-01	Ball Joint (40mm)
8	2571	Hardened Flat Washer 1"	*18	7348	Spacer
9	702030-01	Relay Rod	19	701924-01	Crank Arm Assembly
10	89422312	Lock Nut 1", Gr. C	20	705619-01	Bell Crank Assembly

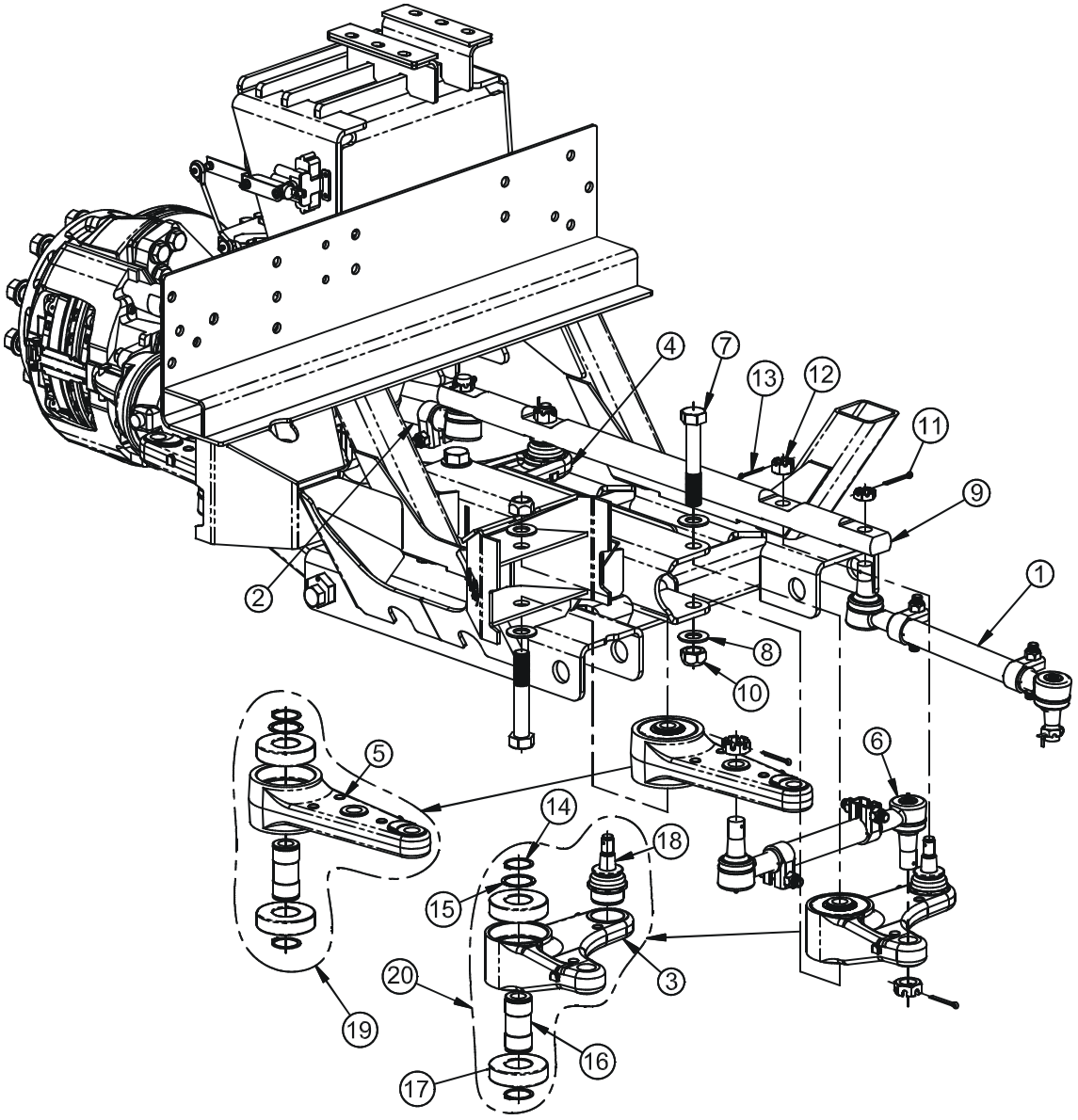
*Components are the same in Bell Crank, Idler Arm and Crank Arm
**Components of Ball Joint Kit K705382.



Steering Components (1800FT)

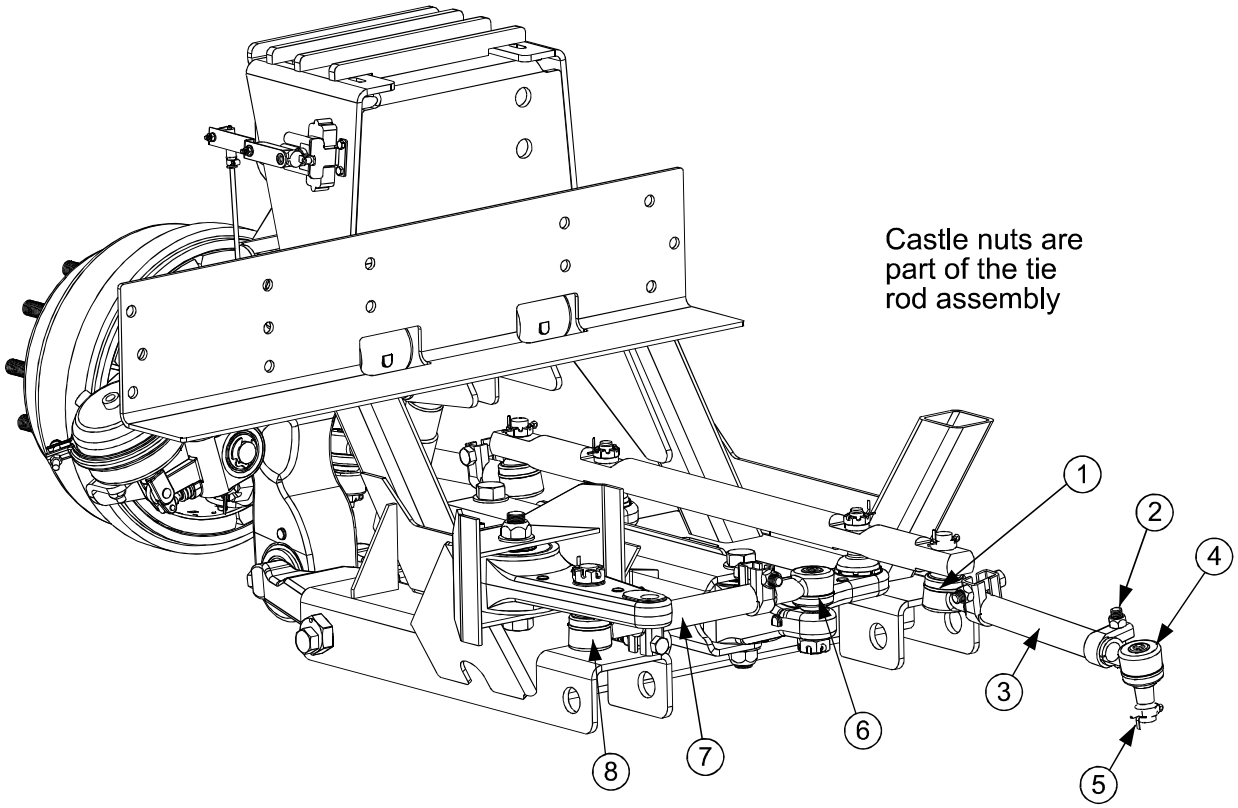
Item	Part No.	Description	Item	Part No.	Description
1	700973-01	Tie Rod Assembly, LH	11	101445-P1	Cotter Pin- 1/8 X 1 1/2
2	700973-02	Tie Rod Assembly, RH	**12	705382-02	Castle Nut, M20 x 1.5
3	700975-01	Bell Crank LH	**13	705382-03	Cotter Pin, 1.40 x .15 Dia.
4	700975-02	Bell Crank RH	*14	6966	Snap Ring
5	701925-01	Crank Arm Assembly	*15	8654	Shim
6	700973-04	Crank Rod Assembly	*16	7348	Spacer
7	167	Hex Head Bolt 1-14 x 6", Gr. 8	*17	701378-01	Bearing
8	2571	HFW 1", 1.062 x 2.00 x .134	**18	705382-01	Ball Joint (40mm)
9	702030-01	Relay Rod	19	701924-01	Crank Arm Assembly
10	89422312	LN 1-14, Gr. C, CP	20	705619-01	Bell Crank Assembly, LH

*Components are the same in Bell Crank and Crank Arm
**Components of Ball Joint Kit K705382



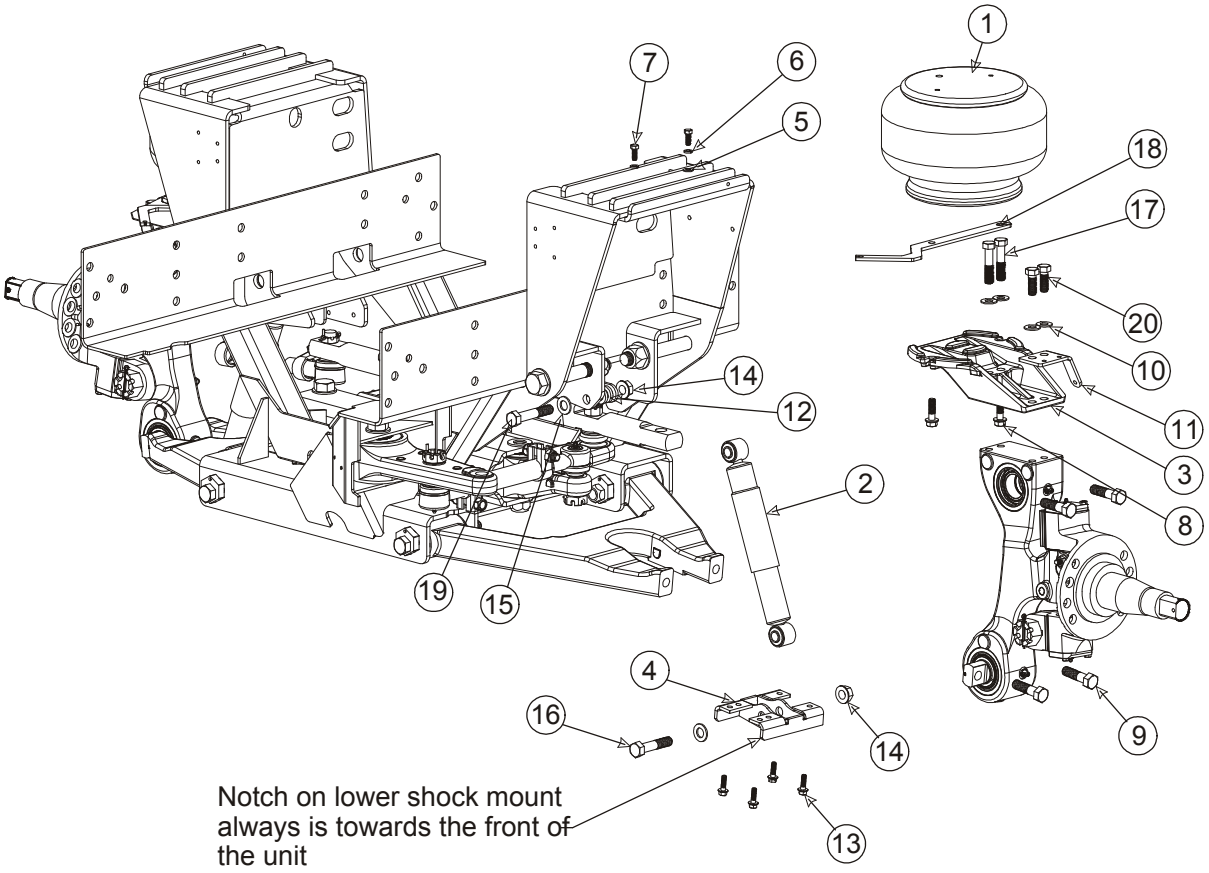
Tie Rod Assemblies

Item	Part No.	Description	Item	Part No.	Description
1	103712	Tie Rod End, RH	5	101445-P1	Cotter Pin
2	6632	Clamp	6	705824-01	Tie Rod End, LH
3	700971-01	Tube, Tie Rod	7	700971-02	Tube, Link
4	103736	Tie Rod End, LH	8	705824-02	Tie Rod End, RH



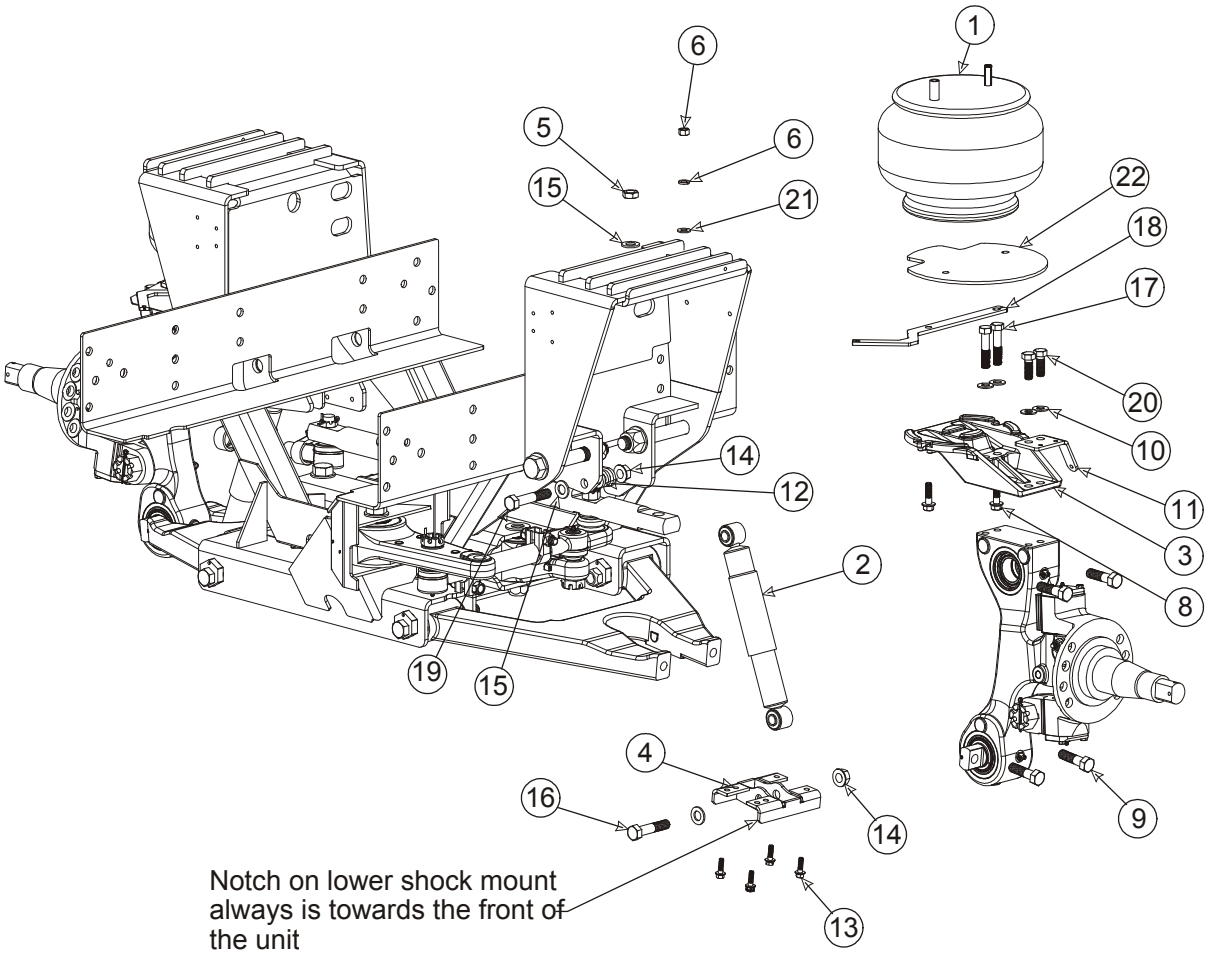
Air Spring, and Shock Components (IFS1660)

Item	Part No.	Description	Item	Part No.	Description
1	705951-01	Air Spring Assembly	10	89422850	HFW 5/8”
2	700178-06	Shock Assembly	11	706026-01	Brake Line Bracket, LH
3	705692-01	Lower Air Spring Mount, Cast LH		706026-02	Brake Line Bracket, RH
	705692-02	Lower Air Spring Mount, Cast, RH	12	152	HFW 3/4”
	704508-01	Lower Air Spring Mount, Fab LH	13	302	FHB 3/8-16 x 1.25" Gr. 8 ZN
	704508-02	Lower Air Spring Mount, Fab, RH	14	208	LFN 3/4-10, Gr. G, ZN
4	707357-01	Lower Shock Mount	15	8131017	FW 3/4" .812 x 1.469 x .134, ZP
5	263	HFW 3/8"	16	100678-P1	HHB 3/4-10 x 3.5, Gr. 8, ZN
6	8120382	SLW 3/8”	17	149	HHB 5/8-18 x 3.00, Gr. 8, ZN
7	100263-P1	HHB 3/8-16 x 1, Gr. 8, ZN	18	706899-01	Arm, HCV
8	276	FHB 1/2-13x1.75 GR.8	19	100727-P1	HHB 3/4-10 x 4.00, Gr. 8, ZN
9	100039-P1	HHB 3/4-10 x 2.75, Gr. 8, ZN	20	700184-04	HHB 5/8-18 x 1 3/4, Gr. 8, ZN



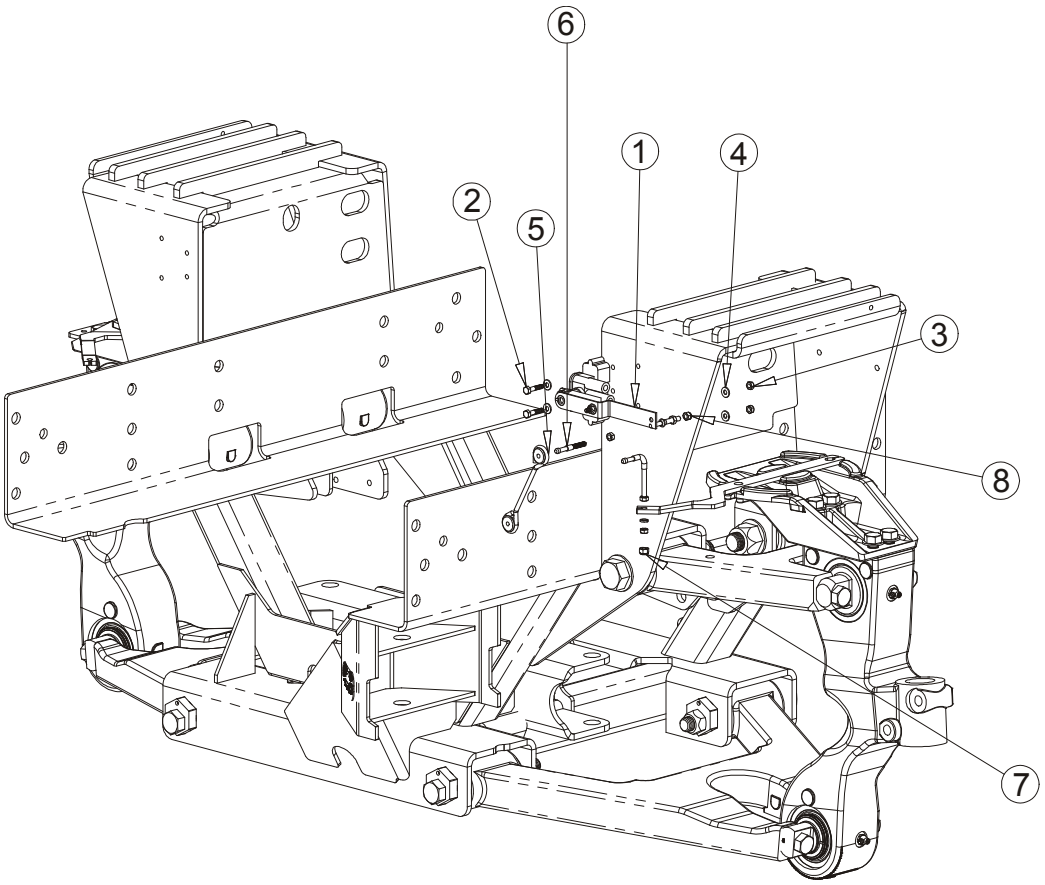
Air Spring & Shock Components (IFS1800)

Item	Part No.	Description	Item	Part No.	Description
1	706841-01	Air Spring Assembly	11	706026-01	Brake Line Bracket, LH
2	700178-06	Shock Assembly		706026-02	Brake Line Bracket, RH
3	705692-01	Lower Air Spring Mount, Cast LH	12	152	HFW 3/4”
	705692-02	Lower Air Spring Mount, Cast, RH	13	302	FHB 3/8-16 x 1.25" Gr. 8 ZN
	704508-01	Lower Air Spring Mount, Fab LH	14	208	LFN 3/4-10, Gr. G, ZN
	704508-02	Lower Air Spring Mount, Fab, RH	15	8131017	FW 3/4" .812 x 1.469 x .134, ZP
4	707357-01	Lower Shock Mount	16	100678-P1	HHB 3/4-10 x 3.5, Gr. 8, ZN
5	8219758	JN 3/4-16, ,Gr. 5, ZP	17	149	HHB 5/8-18 x 3.00, Gr. 8, ZN
6	8120378	N 1/2-13, Gr. 5, ZP	18	706899-01	Arm, HCV
7	8103323	SLW 1/2”	19	100727-P1	HHB 3/4-10 x 4.00, Gr. 8, ZN
8	702638-02	FHB 1/2-13x2.00 GR.8	20	700184-04	HHB 5/8-18 x 1 3/4, Gr. 8, ZN
9	100039-P1	HHB 3/4-10 x 2.75, Gr. 8, ZN	21	118	FW 1/2
10	89422850	HFW 5/8”	22	705860-01	Spacer, Air Spring



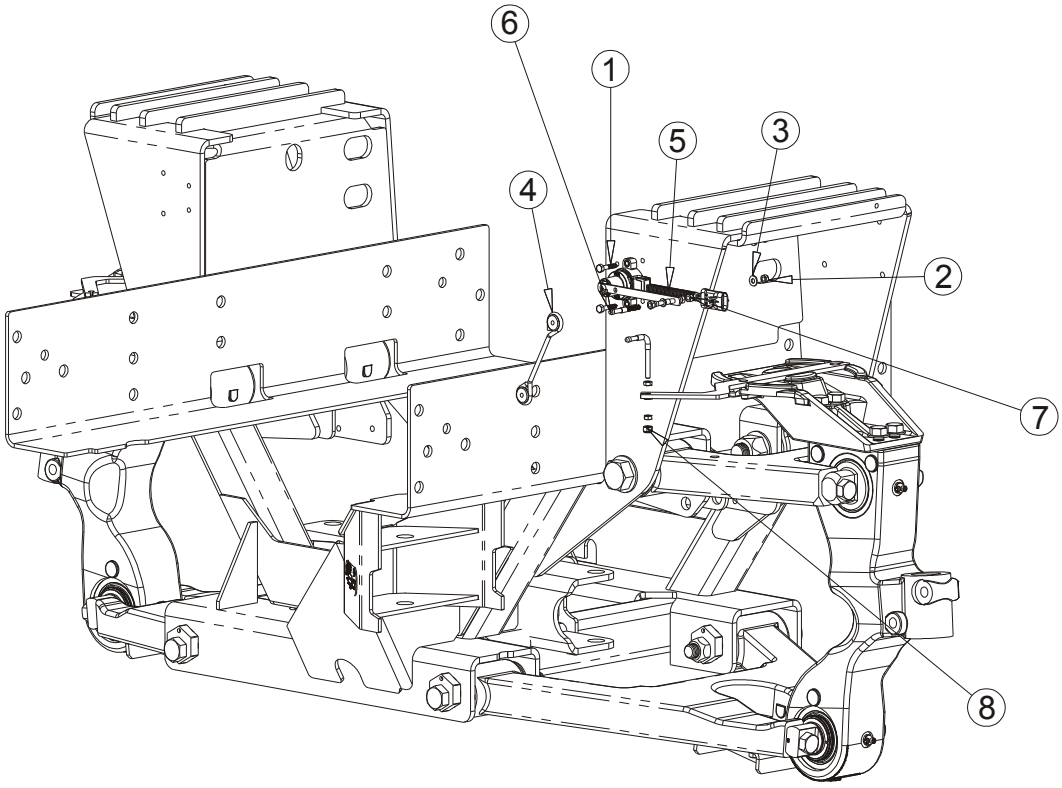
HCV Components

Item	Part No.	Description	Item	Part No.	Description
1	5608	HCV, Standard	5	703915-01	Assembly, Linkage
2	702606-02	HHB 1/4-20 x 1.25”, Gr. 8, ZN	6	705932-01	Pin
3	100703-P1	LN 1/4”	7	705967-01	1/4” Nylock Nut
4	8120392	FW 1/4”	8	705967-02	5/16” Nylock Nut



HCV Components (IFS1660SHC only)

Item	Part No.	Description	Item	Part No.	Description
1	702606-02	HHB 1/4-20 x 1.25”, Gr. 8, ZN	5	705378-01	HCV, Electronic
2	100703-P1	LN ¼”	6	705932-01	Pin
3	8120392	FW ¼”	7	705967-01	1/4” Nylock Nut
4	703915-01	Assembly, Linkage	8	705967-02	5/16” Nylock Nut

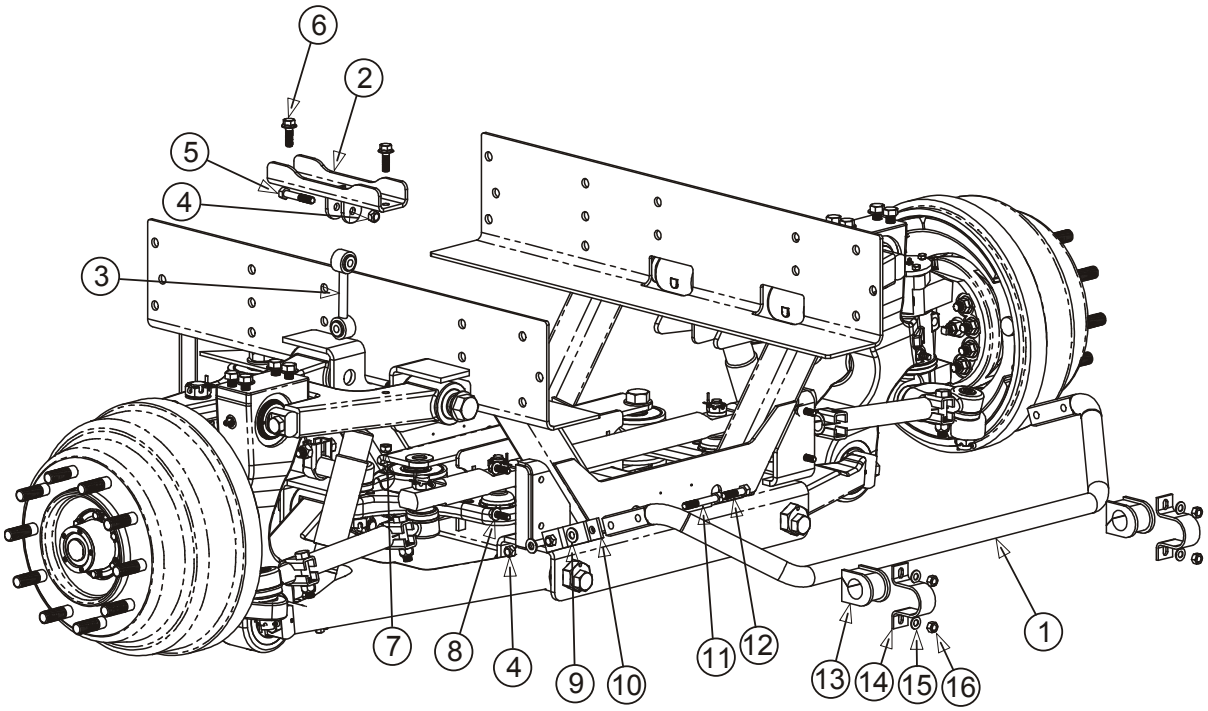


Sway Bar Components (IFS1660S-SB & IFS1800S-FTSB models only)

Item	Part No.	Description	Item	Part No.	Description
1	703124-01	Sway Bar	9	118	FW 1/2" **
2	703165-01	Assembly, Mount, UCA, Sway Bar	10	703128-01	Mount, UCA, Sway Bar *
3	703127-01	Mount, UCA, Sway Bar *	11	100580-P1	HHB 1/2-13 x3.50, Gr. 8, Zinc **
4	89422301	LN 1/2-13, Gr. 8, Zinc **	12	8455001	HHB 1/2-13 x 2.00, Gr. 8, Zinc **
5	102550	HHB 1/2-13 x 2.75, Gr. 8, Zinc **	13	702895-01	Bushing, Split, Sway Bar *
6	307	FHB 1/2-13 x 1.50, Gr. 8, Zinc **	14	702894-01	Mount, D-Ring Sway Bar *
7	89422301	LN 1/2-13, Gr. 8 **	15	702898-01	Washer, Cut, Sway Bar
8	702797-01	FHB 7/16-14 x 1.25, Gr. 8, ZP **	16	89422299	LN 7/16-14 UNC, Gr. 8 **

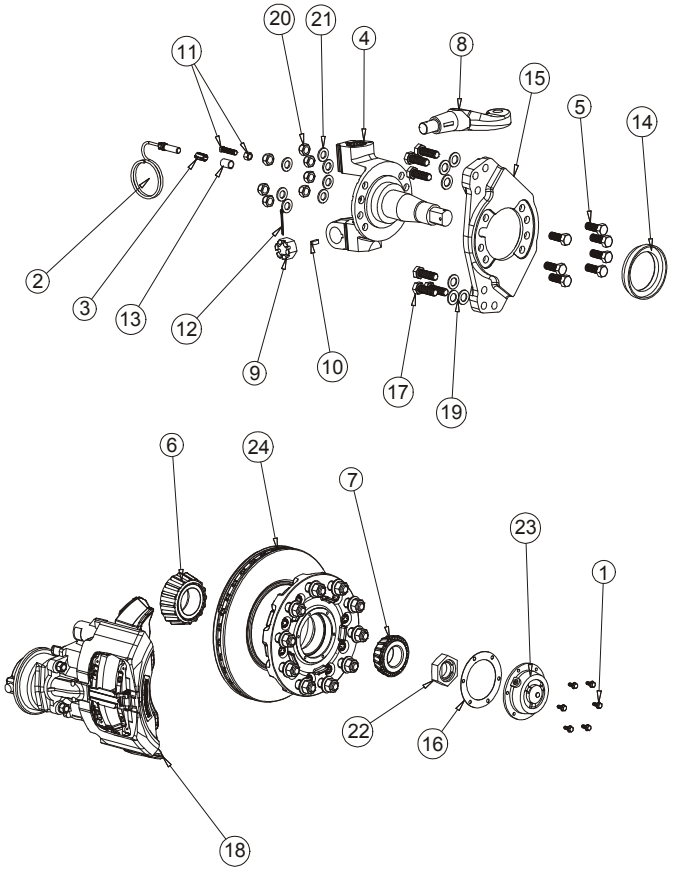
* Items included with K703129

** Items included with K705273



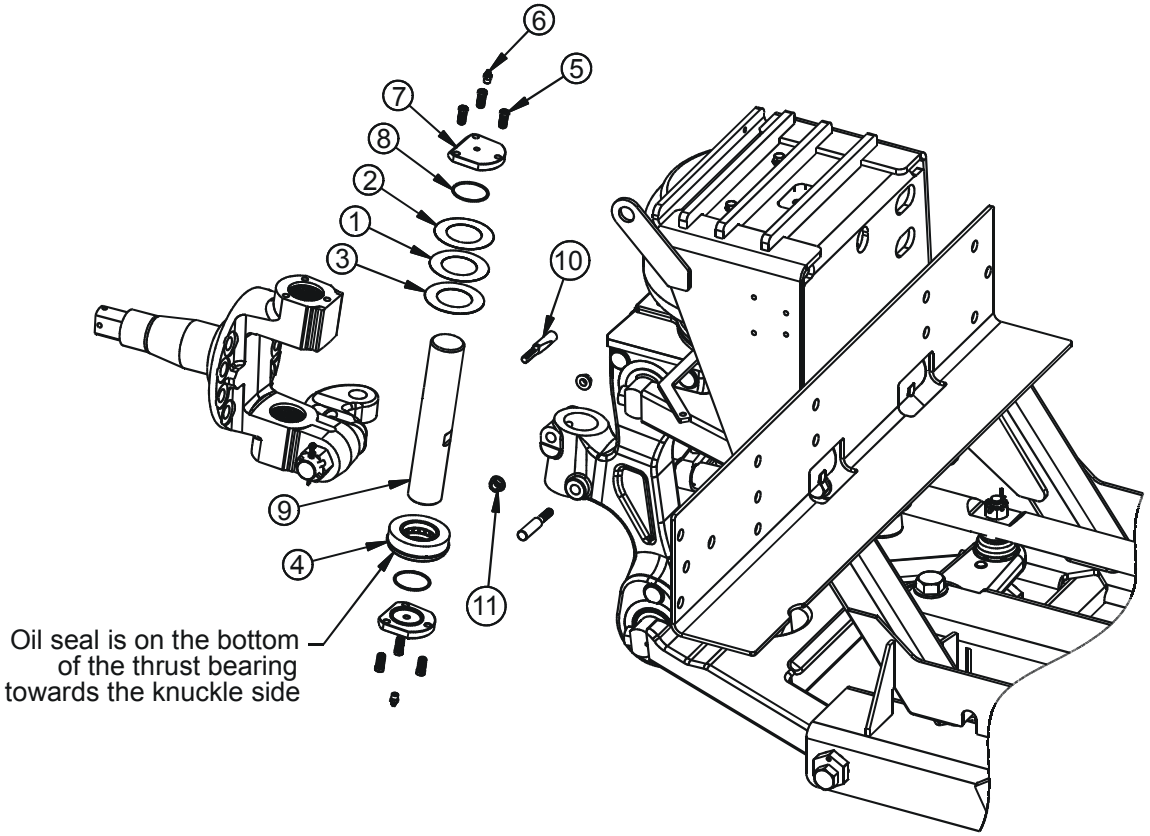
Disc Brake Components

Item No.	Part No.	Description	Item No.	Part No.	Description
1	266	Flange Head Bolt 5/16-18x.75, Gr. 5, ZC	15	705013-01	Torque Plate Assembly, LH *
2	7328	ABS Sensor (Straight w/Lead)		705013-02	Torque Plate Assembly, RH *
3	6946	ABS Sensor Spring Retainer		705013-11	Torque Plate Assembly, LH **
4	705011-01	Steering Knuckle Assembly, LH		705013-12	Torque Plate Assembly, RH **
	705011-02	Steering Knuckle Assembly, RH		705013-15	Torque Plate Assembly, LH ***
5	126	Hex Head Bolt 5/8-18x2, Gr. 8, ZN		705013-16	Torque Plate Assembly, RH ***
6	705051-01	Bearing - Inner	16	1786	Hub Cap Gasket
	705051-02	Bearing Race - Inner	17	700690-04	Hex Head Bolt M20x1.5-50 Gr. 10.9
7	705052-01	Bearing - Outer	18	705013-03	Caliper Assembly, LH
	705052-02	Bearing Race - Outer		705013-08	Caliper Assembly, RH
8	705017-01	Arm, Steering, LH		705013-04	Brake Pads (Set of 4)
	705017-02	Arm, Steering, RH	19	704078-01	Flat Washer 20mm
9	705011-21	Castle Nut 1 1/4 - 12	20	89422308	Locking Flange Nut 5/8-18x.75, Gr. G, PH
10	700525-16	Key	21	103003	HFW 3/4”
11	705011-22	Assembly, Steering Stop	22	708181-01	Nut, Spindle, Pro-Torq
12	705011-23	Cotter Pin 3/16 x 2-1/2	23	708182-01	Hub Cap
13	705011-27	ABS Sensor Bushing	24	705013-05	Hub and Rotor Assembly *
14	705084-01	Oil Seal Assembly		705013-10	Hub and Rotor Assembly **



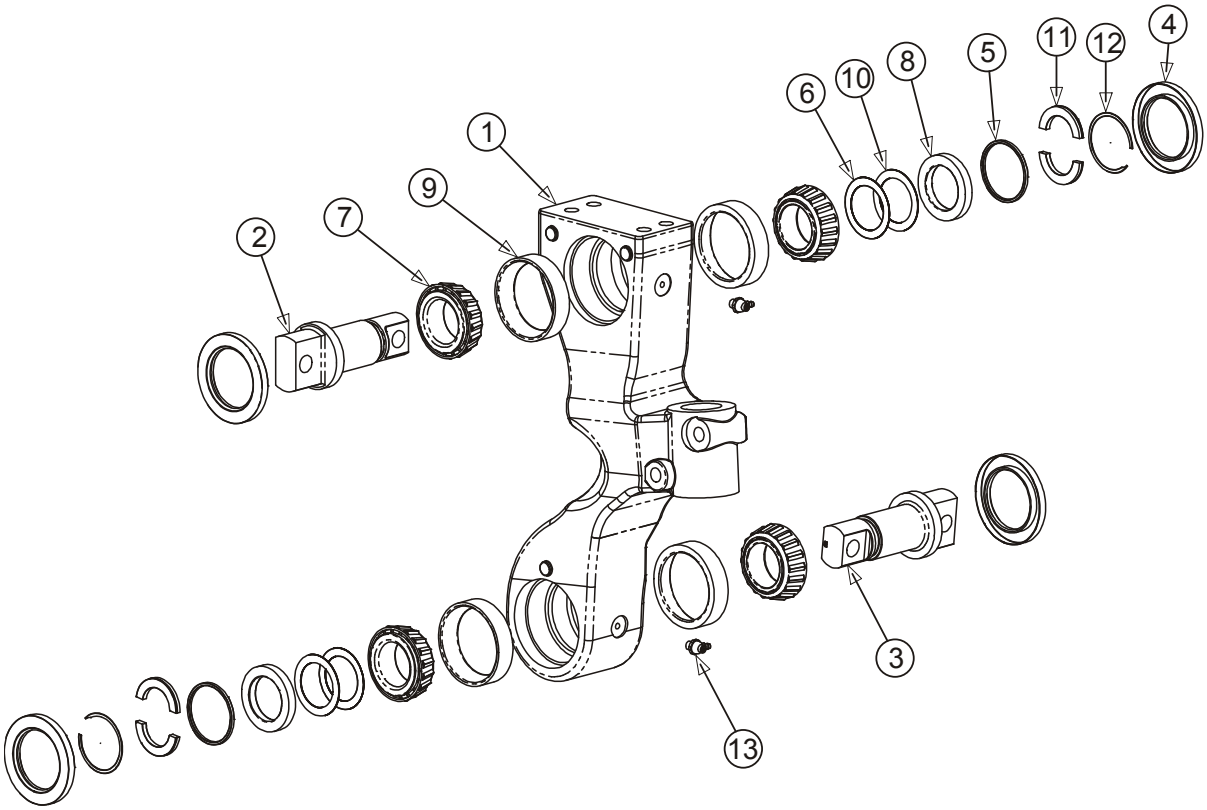
King Pin Components

Item	Part No.	Description	Item	Part No.	Description
1	705011-07	Shim, .005” thick	7	705011-17	Cap, King Pin
2	705011-08	Shim, .010” thick	8	705011-18	O-Ring
3	705011-09	Shim, .020” thick	9	705011-19	King Pin
4	705011-14	Assembly, Bearing, Thrust	10	705315-01	Draw Key, (Long 3.80)
5	705011-15	Bolt, King Pin Cap	11	705316-01	Nut, Draw Key
6	705011-16	Grease Fitting, Straight			



Steering Knuckle Carrier Components

Item	Part No.	Description	Item	Part No.	Description
1	705014-01	Machining, Carrier, LH	7	702834-01	Bearing
	705014-02	Machining, Carrier, RH	8	702622-01	Spacer
2	702621-01	Upper Bar Pin	9	702835-01	Cup
3	702621-02	Lower Bar Pin	10	702623-02	Shim, .010
4	702836-01	Seal	11	702618-01	Split Collar
5	702619-01	Outer Collar	12	702620-01	Retaining Ring
6	702623-01	Shim, .004	13	7352	Grease Zerk, Hydraulic Shutoff



Left Hand Steering Knuckle Carrier Shown

Lubricant Specifications and Intervals

COMPONENT	SERVICE INTERVAL	CHANGE INTERVAL	LUBRICANT SPECIFICATION
Ball Studs on Ends of Tie Rods, Crank Rod, Drag Link	Which ever comes first: Every oil change or every 6 months.	N/A	Multi-Purpose Chassis Grease Premium Multi-Purpose Chassis Grease NLGI Grade 2
Kingpin	Which ever comes first: Every oil change or every 6 months.	N/A	Multi-Purpose Chassis Grease Premium Multi-Purpose Chassis Grease NLGI Grade 2
Carrier Bearings[2]	Which ever comes first: 50,000 miles (80,000 kilometers) or once a year.	N/A	Mobillith AW2 Amoco L Industrial 861 Exxon Ronex MP
Brake S-Cam Tube and Automatic Slack Adjuster [1]	Which ever comes first: Brakes relined. 50,000 miles (80,000 kilometers) or once a year.	N/A	Premium Multi-Purpose Chassis Grease NLGI Grade 2
Wheel End	1000 miles (1600 kilometers) Check fluid level.	Which ever comes first: Seals replaced, brakes relined, 100,000 miles (160,000 km), or once a year.	Gear Oil SAE 80W/90 or equivalent

1. Moly-disulfide type grease is not recommended since it may lower friction capabilities in the adjusting clutch parts of the automatic slack adjuster.
2. Use caution when using an automatic grease gun or seals could possibly be blown out and damaged.

General Lubrication

Proper lubrication practices are important in maximizing the service life of your ReycoGranning® Independent Front Suspension.

⚠ CAUTION

Do not mix lubricants of different grades. Do not mix mineral and synthetic lubricants. Different brands of the same grade may be mixed.

⚠ CAUTION

Never mix oil bath and grease packed wheel ends.

Ball Joints

The ball joints are lubricated and sealed for their service life and do not require lubrication. Check for oil or grease marks on the exterior of the seal and if found verify that the seal has not been ruptured. If the seal has been ruptured then the ball joint must be replaced because it cannot be re-lubricated.

Ball Studs on Tie Rods, Crank Rod, and Drag Link

1. Review lubricant specification and interval requirements before servicing.
2. Apply lubricant to grease fitting until new lubricant discharges from the dust boot (Figure 4).

Brake S-Cam Tube and Automatic Slack Adjuster

1. Review lubricant specification and interval requirements before servicing.
2. Apply lubricant to the S-cam tube until new lubricant discharges from the S-camshaft bushing seal next to the automatic slack adjuster. (Figure 4).
3. Apply lubricant to the automatic slack adjuster until new lubricant discharges from the cone clutch adjacent the adjusting hex nut. (Figure 4).

Carrier Bearing and Kingpin

1. Apply lubricant to both upper and lower carrier bearings and kingpin bushings until new lubricant discharges from the carrier bearing seals and in between the steering knuckle kingpin housing and carrier.

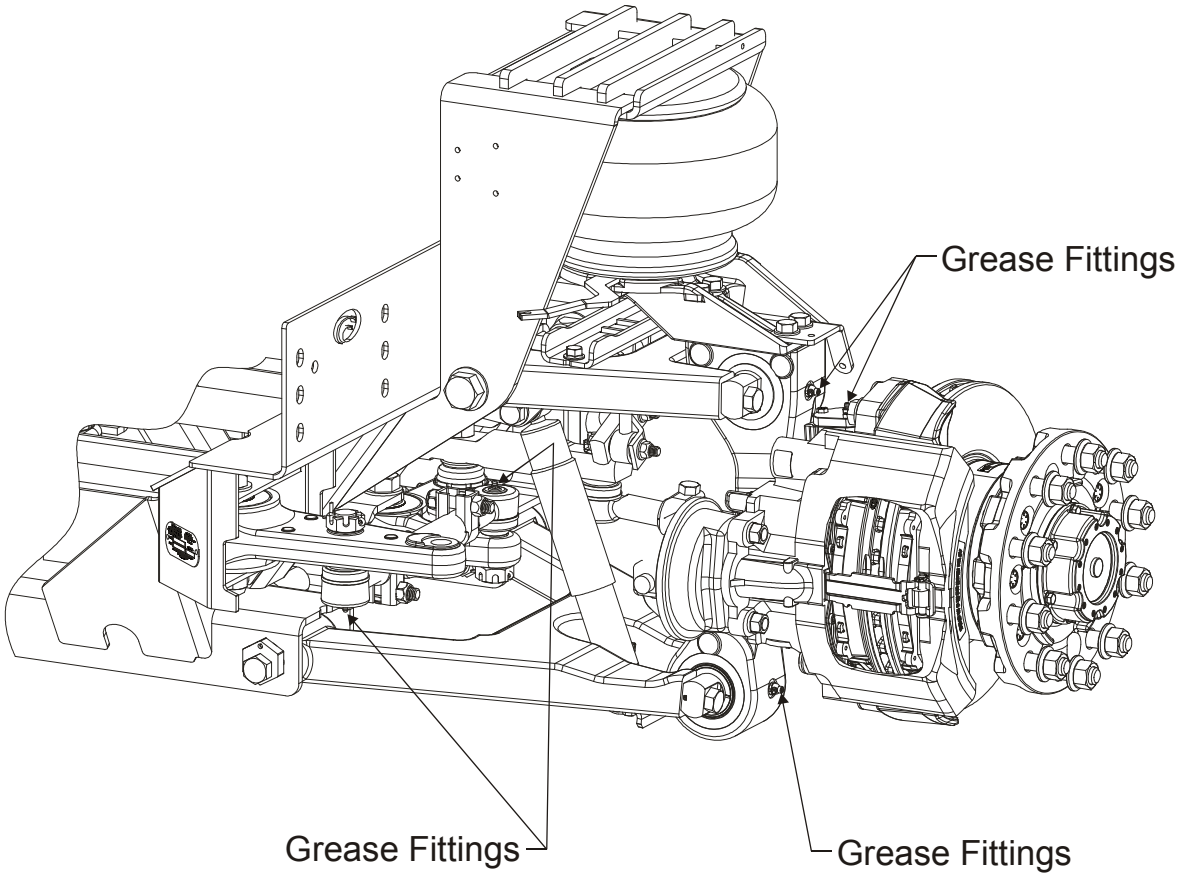


Figure 4 – Location of lubrication fittings. Note: Left side only shown.

Wheel Bearings

1. Review lubricant specification and interval requirements before servicing.
2. Check oil level through hub cap window. If level is below the “add” level line then remove the pipe plug and fill with recommended oil until “full” level is achieved. (Figure 5). Add oil slowly since the heavy weight oil will settle slowly in the hub. (Note: The hub cap window can only be cleaned with mild soap and water. Aromatic solvents should not be used, as they will impair the transparency of the window.)
3. Check the hub cap for external oil marks. The vent plug will normally weep a small amount of oil. Oil marks in other locations should be addressed by replacing the hub cap seal, window gasket, or tightening the pipe fill plug.

⚠ CAUTION

Do not remove or twist the red plug on the front of the hub cap. This will damage the hub cap, and cause oil to leak. Add oil only thru the pipe plug or warranty will be void.

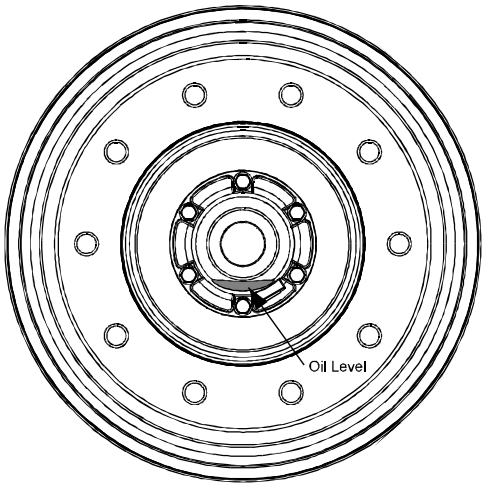


Figure 5 - Wheel Bearing Oil Level

Troubleshooting

SYMPTOMS	POSSIBLE CAUSES	REMEDIES
Tires wear out quickly or have uneven tire tread wear. **Note:** *Wear pattern will indicate possible cause(s). Consult tire manufacturer for guidance.*	Tires have incorrect pressure.	Put specified air pressure in tires.
	Tires out of balance.	Balance or replace tires.
	Incorrect toe-in setting.	Adjust toe-in to specified setting.
	Incorrect ride height.	Adjust ride height to specified setting.
	Incorrect rear axle alignment.	Align rear axle to specified thrust angle.
	Incorrect steering arm geometry.	Adjust tie rod lengths as required.
	Improper (mismatched) tires and wheels.	Install correct tire and wheel combination.
Vehicle is difficult to steer. **Note:** *Engine must be running for power steering to be active and able to provide steering assist.*	Improper oversized tires.	Install correct tire and wheel combination.
	Tires not uniform.	Install correct tire and wheel combination.
	Tires have incorrect pressure.	Put specified air pressure in tires.
	Incorrect steering arm geometry.	Adjust tie rod lengths as required.
	Steering arms binding.	Check steering arm bearings and lubricate as needed.
	Steering arm ball joints binding.	Inspect ball joints for wear and replace as required.
	Tie rod ends binding.	Inspect tie rod ends for wear and lubricate as needed.
	Kingpin binding.	Inspect, lubricate, and repair as required.
	Steering column linkage binding.	Align or adjust as required.
	Steering miter box binding.	Check steering miter box and repair or replace as required.
	Steering gear valve binding.	Inspect, repair or replace as required.
	Steering wheel to column interference.	Align or adjust as required.
	Power steering pump fluid level low and/or possible leak in system.	Add fluid, tighten connections and correct as needed.
	Power steering pump pressure and flow below specification.	Conduct pump flow and relief pressure tests and adjust, repair or replace as needed.
	Air in power steering system.	Add fluid, tighten connections and bleed system.
	Contaminated or incorrect fluid.	Replace with correctly specified fluid.
	Obstruction with steering gear pitman arm or within hydraulic lines.	Inspect, remove obstruction(s) and repair or replace as required.
	Obstruction within wheelhouse.	Inspect, remove obstruction(s) as required.
	Excessive internal steering gear leakage.	Inspect, repair or replace as required.

SYMPTOMS	POSSIBLE CAUSES	REMEDIES
Vehicle wanders side-to-side…loose steering. **Steering wheel has large amplitude, rotational oscillations when hitting large bumps.**	Vehicle overloaded or unevenly loaded driver side to passenger side.	Check wheel loads and correct as needed.
	Improper (mismatched) tires and wheels.	Install correct tire and wheel combination.
	Tires have incorrect pressure.	Put correct air pressure in tires based on wheel load.
	Incorrect toe-in setting.	Adjust toe-in to specified setting.
	Incorrect wheel caster setting.	Adjust wheel caster to specified setting.
	Tie rod end connection loose or ball stud worn.	Inspect ball stud connections and wear.
	Steering arm mounts loose.	Check and tighten to specification.
	Steering arm ball joints binding or worn.	Inspect ball joints for wear or contamination and replace as required.
	Kingpin worn.	Check and replace as required.
	Wheel bearings out of adjustment.	Check wheel bearing end play and adjust as required.
	Loose steering gear mounting.	Check mounting and secure as needed.
	Loose pitman arm.	Check pitman arm and tighten as required.
	Steering column linkage worn.	Check for wear and repair or replace as needed.
	Steering gear adjustment.	Check and adjust to specification.
	Steering column mis-aligned.	Realign steering column as required.
	Worn knuckle carrier bearings.	Check, adjust, or replace as needed.
	Loose knuckle carrier mounting bolts.	Check and tighten as needed.
	Loose wheel nuts.	Check and tighten to specification.
Vehicle pulls to one side without the brakes applied.	Vehicle overloaded or unevenly loaded driver side to passenger side.	Check wheel loads and correct as needed.
	Improper (mismatched) tires and wheels.	Install correct tire and wheel combination.
	Tires have incorrect pressure.	Put correct air pressure in tires based on wheel load.
	Unequal ride height side to side.	Inspect ride height and adjust to specified setting.
	Improper brake adjustment.	Inspect and adjust slack adjusters as required.
	Incorrect rear axle alignment.	Align rear axle to specified thrust angle.
	Incorrect caster and/or camber setting.	Check and adjust as required.
	Wheel bearings out of adjustment.	Check wheel bearing end play and adjust as required.
	Loose steering gear mounting.	Check mounting and secure as needed.
	Tie rod end connection loose or ball stud worn.	Inspect ball stud connections and wear.
	Bent spindle or steering arm.	Inspect and replace as required.
	Frame or underbody out of alignment.	Inspect and correct as required.
	Incorrect toe-in setting.	Adjust toe-in to specified setting.
	Mis-aligned belts in radial tires.	Check and replace as needed.
	Steering gear valve binding.	Inspect, repair or replace as required.
	Steering gear not centered.	Inspect and adjust as required.
	Excessive internal steering gear leakage.	Inspect, repair or replace as required.
	Excessive water puddling on road.	Avoid water puddles on road.

SYMPTOMS	POSSIBLE CAUSES	REMEDIES
Vehicle pulls to one side with the brakes applied.	Grease, oil or dirt on brake linings.	Replace brake linings as required.
	Brake linings are glazed.	Deglaze brake linings by burnishing or replace as required.
	Brake linings are not a balanced set, different friction codes or lining brand.	Replace brake linings as required.
	Loose or broken brake linings.	Replace brake linings as required.
	Brake drum out of round.	Re-machine or replace brake drum as required.
	Defective brake drum.	Inspect for defects and replace as required.
	Brake air chamber clevis pin or camshaft binding.	Check and lubricate as needed.
	Defective slack adjuster.	Inspect for defects and replace as required.
	Uneven brake adjustment side to side.	Adjust slack adjuster as required.
	Different brake air chamber size or slack adjuster length side to side.	Replace with same size brake air chambers and length slack adjusters.
	Brake chambers air pressure uneven side to side.	Check side-to-side air pressure and correct as needed.
	Unequal brake air chamber stroke side to side.	Check side-to-side stroke and adjust as required.
	Rear axle brakes mis-adjusted or contaminated.	Check, adjust, or replace as required.
	ABS system malfunction.	Check ABS system for proper function.
	Air leak or obstruction in air brake lines.	Check fittings with soapy water solution and remove obstructions.
	Brake air chamber air leak or diaphragm damaged.	Check chamber for air leak and damaged diaphragm.
	Excessive water puddling on road.	Avoid water puddles on road.
Vehicle rolls side to side excessively.	Front and/or rear shock absorbers worn.	Replace shock absorbers as needed.
	Shock mounting loose.	Check and tighten as required.
	Shock eye bushings worn.	Check and replace as needed.
	Sway bar bushings worn.	Check sway bar bushings and replace as needed.
	Sway bar mounting brackets loose.	Check sway bar mounting brackets and tighten as needed.
	Control arm pivot bushings worn.	Inspect and replace as required.
	Internal leak in height control valve.	Check height control valve and replace as required.
Front tires lock up during hard braking or ABS malfunction light remains lit.	ABS sensor malfunction.	Inspect ABS sensor installation and replace sensor as required.
	ABS CPU or system malfunction.	Check and repair or replace as required.
	ABS sensor electrical connection faulty.	Check ABS sensor connection and lead wire.
	Tone ring on hub damaged.	Check for damage and replace as required.

SYMPTOMS	POSSIBLE CAUSES	REMEDIES
Vehicle ride is too harsh and/or suspension contacts stops excessively.	Front shock absorbers worn.	Replace shock absorbers as needed.
	Incorrect ride height.	Adjust ride height to specified setting.
	Vehicle overloaded.	Check wheel loads and correct as needed.
	Air spring supply lines leaking or obstructed.	Check air line connections and remove obstructions.
	Vehicle system air pressure below specification.	Check air pressure and correct as needed.
	Rebound bumper worn or missing.	Check and replace as needed.
	Jounce bumper in air spring worn or broken.	Check and replace air spring as required.
Vehicle ride is too soft.	Front shock absorbers worn.	Replace shock absorbers as needed.
	Incorrect ride height.	Adjust ride height to specified setting.
Vehicle has unequal turning radius right to left.	Incorrect steering arm geometry.	Adjust tie rod lengths as required.
	Steering gear not centered.	Inspect and adjust as required.
	Steering gear poppet valves set incorrectly.	Check wheel turn angles and adjust as required.
	Tie rod clamps positioned improperly.	Check orientation and adjust as needed.
Suspension does not maintain ride height.	Air leak.	Check connections with soapy water solution and repair or replace as needed.
	Internal leak in height control valve.	Check height control valve and replace as required.
	Height control valve linkage loose.	Check and tighten linkage as needed.
	Air spring chafed or worn.	Check air spring and replace as needed.
Brakes are noisy.	Grease, oil or dirt on brake linings.	Replace brake linings as required.
	Brake linings are glazed.	Deglaze brake linings by burnishing or replace as required.
	Brake linings are not a balanced set, different friction codes or lining brand.	Replace brake linings as required.
	Loose or broken brake linings.	Replace brake linings as required.
	Brake drum out of round.	Re-machine brake drum as required.
	Defective brake drum.	Inspect for defects and replace as required.
	Excessive dirt built up in brake drum cavity.	Remove excessive dirt from brake drum cavity.

Refer to Bendix Disc Brakes manual Y006471 for troubleshooting of the disc brakes or contact Customer service at 1-800-247-2725.

Inspection

General Inspection

Perform a thorough visual inspection of the suspension to ensure proper assembly and to identify broken parts and loose fasteners each time the vehicle suspension is serviced. Do the following during an inspection.

- Wheel Alignment - Follow the guidelines in the Front Wheel Alignment section for wheel alignment inspection intervals. Check wheel alignment if excessive steering effort, vehicle wander, or abnormal tire wear is evident.
- Fasteners - Check that all the fasteners are tightened to the proper tightening torque. Use a calibrated torque wrench to check torque.
- Wear and Damage - Inspect components of the suspension for wear and damage. Look for bent or broken components. Replace all worn or damaged components.
- Operation - Check that all components move freely through the complete wheel turning arc.

⚠ CAUTION

Tuthill Transport Technologies recommends replacing any damaged or out-of-specification components. Reconditioning or field repairs of front suspension components is prohibited. Some cast components are heat-treated. These components as well as other non-heat treated castings cannot be bent, welded, heated, or repaired in any way without reducing the strength or life of the component thus voiding the warranty. Only genuine ReycoGranning® replacement components are allowed.

⚠ WARNING

Never work under a vehicle supported by only a jack(s). Jacks can slip or fall over and cause serious personal injury. Always use safety stands. Do not place jacks or safety stands under the lower control arms to support the vehicle. Lower control arms are not stationary components and could move allowing the vehicle drop causing serious personal injury.

The vehicle may be supported on safety stands by the suspension subframe or chassis frame for inspections that require removal of the wheel and tires or deflation of the air springs. Always secure the vehicle by setting the parking brake and block the drive wheels to prevent vehicle movement before inspections.

Inspecting the Control Arm Bushings for Wear

NOTE

It is recommended that the bushings in all of the control arms be replaced at the same time if one is found worn.

1. Check clearance between each control arm and subframe-bushing mount. Look for contact pattern as evidence of bushing wear. Replace worn bushings in both control arm housings as needed.
2. Check for bushing bulging between the control arm and subframe mount or presence of small rubber particles near subframe bushing mount.

3. Check that the control arm mounting bolts are tight. Recommended torque is **460-490 lbf·ft**. for lower control arms and **950-1050 lbf·ft** for upper control arms. See Torque Table. A loose joint will result in wear between the bushing inner sleeve and subframe mount.

Inspecting the Tie Rod Ends

⚠ WARNING

Do not use a wrench or other object to apply leverage when inspecting tie rod end sockets. Applying leverage can yield incorrect results and damage components. Component damage can lead to the loss of steering control.

1. With the engine on, lightly rock the steering wheel and have an assistant observe any looseness in the two mating tapers or any movement of the stud nut at both ends of the tie rod. (Figure 6). If looseness is found in either place go to step 2, otherwise skip to step 3.
2. Remove the tie rod end ball stud from the taper mount and visually inspect both. If either of the mating tapers shows distortion or wear, then both components must be replaced. Torque tie rod castle nuts to **90-100 lbf·ft**. See Torque Table.
3. With the engine off and the wheels steered straight ahead, grab the tie rod near its end and try to move the socket in a direction parallel to the ball stud axis. (Figure 6). Be sure to only apply hand pressure to the tie rod.
4. Measure the axial movement with a scale. If the movement is greater than 1/8 inch (3mm) replace the tie rod end immediately. If the socket moves but the movement is less than 1/8 inch (3mm) then the tie rod end should be replaced before 1/8” (3mm) movement occurs.
5. Check dust boot for damage. Replace as needed.
6. Check tie rod clamp orientation (Figure 6)

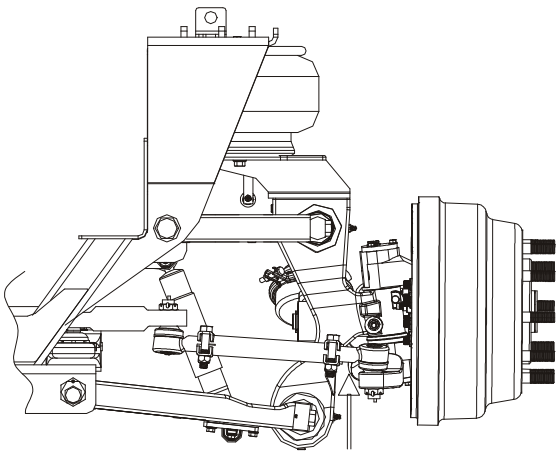


Figure 6 - Tie Rod

Inspecting the Automatic Slack Adjusters and Brake System

Automatic Slack Adjusters

The suspension system is equipped with automatic slack adjusters for steer axles. For inspection and adjustment refer the Crewson-Bruner Adjustment Guidelines.

Brake System

The suspension system is equipped with Dana 16.5x5 S-cam air brakes. Refer to Dana maintenance manual #SHA 589-1 5M inspection and service procedures.

Inspecting the ABS Sensor and Tone Ring

1. The tires and brake drums may be removed if needed to ease inspection of tone ring and sensor.
2. Disconnect the ABS sensor lead from the chassis connector.
3. The ABS sensor test will require a voltmeter that can measure AC voltage on a millivolt scale.
4. Connect the voltmeter to the connector pins of the ABS sensor lead.
5. Set the voltmeter scale to millivolts and the voltage source to AC volts.
6. Rotate the wheel hub by hand and record the voltage output from the ABS sensor. A minimum output of 800 millivolts is normal.
7. If the minimum voltage output is not achieved, check lead wire connections and repeat Step 3. Otherwise, if the minimum voltage output is not achieved after repeating Step 3 then go to Step 5.
8. Check physical gap between the sensor and tone ring (Figure 7). The brake drum must be removed to inspect gap. The maximum allowable gap is .027 inch. If the gap is greater than .027 inch, press on the wire lead end of the sensor and push the sensor into contact with the tone ring. Check that the ABS spring retainer and bushing are not unseated. Re-seat components as needed.
9. Inspect the tone ring on the hub for physical damage and proper installation onto the hub. The tone ring should have a maximum run out of .008 inch relative to the hub/spindle centerline.
10. Repeat Step 3. If voltage output is less than 800 millivolts then replace the ABS sensor (Note: Check voltage output of new sensor).

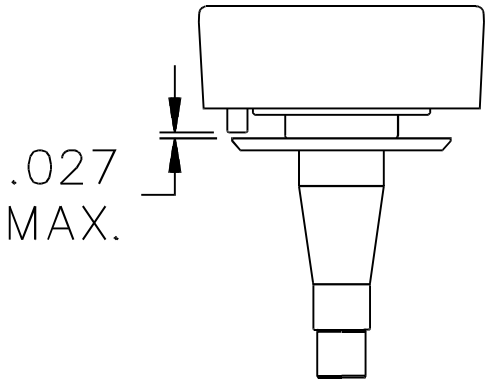


Figure 7 - ABS Sensor and Tone Ring Gap

Inspecting the Shock Absorber

1. Check shock absorbers for oil leakage, bent components, missing or broken components, excessive corrosion, or worn bushings. Replace shock absorbers if any of the above items is present.

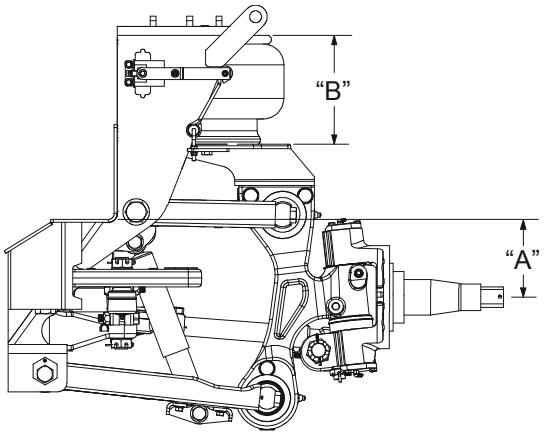
Inspecting the Air Spring and Height Control Valve

Air Spring Inspection

1. Refer to Firestone's Preventative Maintenance Checklist for additional air spring information.
2. Check the outside diameter of the air spring for irregular wear or heat checking.
3. Check airlines to make sure contact does not exist between the airlines and the outside diameter of the air spring. Re-secure airlines to prevent contact as needed. Check for airline and fitting leaks with soapy water solution.
4. Check to see that there is minimum of 1-inch clearance around the circumference of the air spring while it is energized with air.
5. Check the air spring piston for build up of foreign material. Remove any foreign material that is present.

Height Control Valve Inspection

1. Check the height control valve and linkage for damage. Replace components as needed.
2. Dump and re-inflate the air suspension.
3. Verify the ride height by measuring from wheel center to the bottom of the frame ("A") or air spring height ("B"). If the dimensions are not within +/- .125" of (figure 8), readjust.
4. The actuation arm of the height control valve should be horizontal at ride height (Figures 8). See section for adjusting to correct ride height.



Unit	Ride Height "A"	Air Spring "B"
IFS1660	6.60"	9.25"
IFS1800	9.06"	9.25"

Figure 8 - Ride Height Measurement

Inspecting the Steering Arm Bearings

1. Check that steering arm pivots are free of foreign material and bearing seals are in place.
2. Start vehicle engine. Oscillate the steering wheel and observe the motion of the steering arms (Figure 9). The steering arms should not exhibit any noticeable conical motion about their pivot axes.
3. If any conical motion is observed check pivot bolt torque which should be **460-490 lbf·ft**. See Torque Table. Otherwise, replace the bearing set of the steering arm that exhibits conical motion.

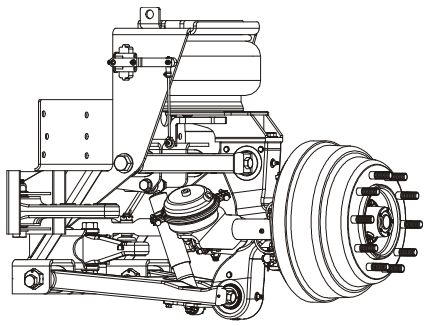


Figure 9 - Steering Arms

Inspecting the Steering Arm Ball Joints

Seal Inspection

1. Inspect the ball joint seal outer surface for presence of oil "wetting". The entire outer seal surface should be dry. Use a mechanics mirror and flashlight to inspect the entire seal. Use a blunt object as needed to inspect between seal convolutes.
2. If oil "wetting" is found, then inspect the entire wet area to confirm the seal has a rupture(s) and oil source is from internal grease leaking from the ball joint. If seal is ruptured, then the ball joint must be replaced.
3. Skip ball joint endplay measurement.

NOTE
Care must be taken to not damage ball joint seals during inspection. Seals that are ruptured during inspection must be replaced. Do not apply excessive force to pry ball joints.

Endplay Inspection

1. Install a dial indicator with a magnetic base so that the base is fixed to the steering arm. Place the indicator tip on the flat area of the relay rod adjacent the castle nut.
2. Using a C-clamp, squeeze the relay arm and the steering arm together to seat the ball joint. Do not apply excessive clamp load.
3. Set the dial indicator on "zero".
4. Release the clamp. Place the pry bar between the steering arm and relay arm. **Do not allow the pry bar to contact the ball joint seal.** Firmly pry upward using the steering arm as a fulcrum to lift the relay arm. The pry load must not cause the relay arm to rotate thus causing the relay to change orientation.
5. Record the dial indicator reading. A reading greater than .040" will require ball joint replacement.
6. Inspect ball joint seal for damage and replace the ball joint if damaged during measurement process.

Inspecting Wheel Bearing Endplay

1. If the tire and wheel are not removed make sure all the wheel nuts are tightened to the specified torque of **450-500 lbf·ft**. See Torque Table.
2. If the tire and wheel are removed (recommended for aluminum wheels) secure the brake drum to the hub with the wheel nuts or remove the brake drum.
3. Remove the vent plug from the hubcap.
4. Attach a dial indicator with a magnetic base to the face of the wheel, hub, or brake drum. The dial indicator may also be attached to the bottom of the brake drum if the wheel is removed.
5. Place the tip of the dial indicator on the center of the steering knuckle spindle. Set the dial indicator on zero. (Figure 10).

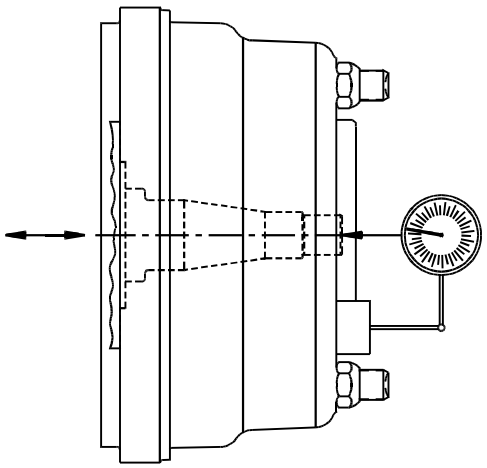


Figure 10 - Wheel End Play Measurement

NOTE
Do not push/pull at the top and the bottom of the tire, drum, or hub. Pushing or pulling at the top and the bottom will not yield a true measurement of the endplay.

6. Measure the endplay by simultaneously pushing/pulling on each side of the tire, drum, or hub while observing the dial indicator. The endplay is the total travel observed. If the endplay is not within .001-.005", see the section on adjusting the wheel bearing endplay.

Inspecting the Knuckle Carrier Bearing and Seal

1. Inspect the seals for damage.
2. Place the magnetic base of a dial indicator on the knuckle carrier and position the tip of the dial on the end of the bar pin such that axial movement can be measured.
3. Set the dial indicator to "0" (zero).
4. Place a pry bar between the control arm and carrier and pry to measure axial movement of the bar pin. Do not pry on seal. Measure and record the dial indicator reading.
5. If the axial endplay is more than "0" inch, then replace the carrier bearings. See repair section on knuckle carrier.

Inspecting the Kingpin Vertical Endplay

1. Turn the tire straight ahead.
2. Place the magnetic base of a dial indicator on the knuckle carrier and position the tip of the dial on top of the king pin bearing cap such that vertical movement can be measured.
3. Place a portable jack and a suitable block (one with clearance for the grease fitting) under the lower king pin grease cap area.
4. Set the dial indicator to "0" (zero).
5. Raise the jack until the dial indicator shows the end of vertical travel. Measure and record the dial indicator reading. Vertical inspection clearance must be .006-.012 inches.
6. If the steering knuckles binds or less than .001 inch endplay is measured, remove shims from the shim pack. See repair section for kingpin.
7. If the vertical endplay measurement is more than .012 inches, then install shims. See repair section for kingpin.

Adjusting Wheel End Play

⚠ WARNING

Never work under a vehicle supported by only a jack(s). Jacks can slip or fall over and cause serious personal injury. Always use safety stands. Do not place jacks or safety stands under the lower control arms to support the vehicle. Lower control arms are not stationary components and could move allowing the vehicle drop causing serious personal injury.

⚠ WARNING

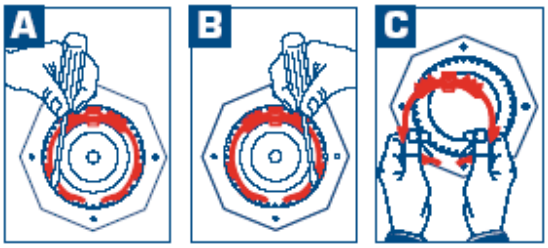
Failure to follow this instruction could cause the wheel to come off and cause bodily injury. The PRO-TORQ® Spindle Nut is sold as an assembly with the keeper in place. DO NOT attempt to place the nut on the spindle or tighten or loosen the nut on the spindle while the keeper is locked inside the nut. Doing so may deform the keeper and allow the nut to unthread during operation.

1. Secure the vehicle by setting the parking brake and block the drive wheels to prevent vehicle movement.
2. Raise the vehicle until the front wheels are off the ground. Support the raised vehicle with safety stands.
3. Place an oil drip tub beneath the hub to catch oil. Rotate the hub such that the hubcap drain plug is facing upwards. Remove the drain plug from the hubcap and place it in a container for re-installation.
4. Rotate the hub such that the drain hole faces downward and drain the oil from hub cavity. Wait a few minutes for most of the oil to drain before continuing to the next step.
5. Remove the hubcap bolts, hubcap, and gasket. Take care not to damage the gasket for re-installation. Place the components in a location to prevent contamination. Note that solvents may damage the hubcap window.

NOTE

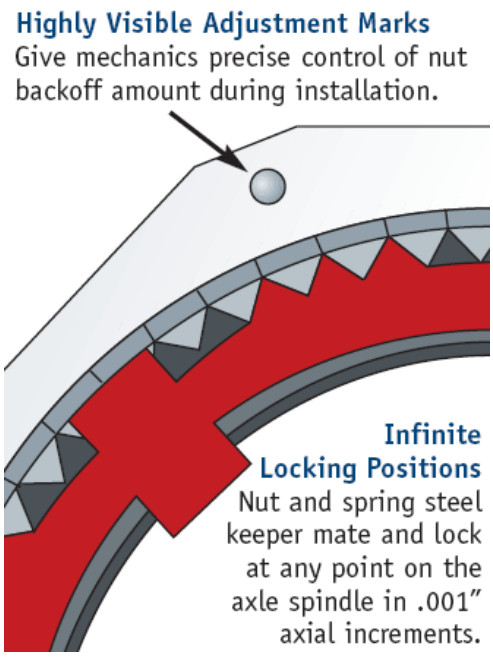
When removing or installing the inner and outer spindle nuts, use the correct wrench sockets to avoid damaging the nuts. Do not use impact driver to tighten inner and outer nuts. Only use a torque wrench to tighten the nuts.

6. Remove the keeper from the nut.

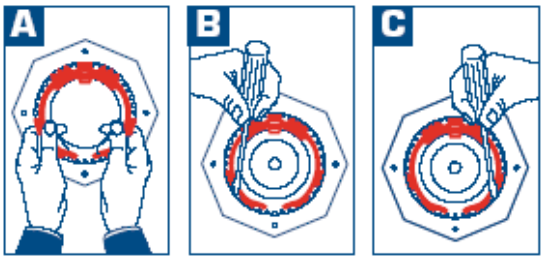


7. A, B, C Use a small screwdriver to carefully pry the keeper arm from the undercut groove on each side until the keeper is released.
8. Seat the bearing, with the hub or hub and drum only using a torque wrench.

9. Tighten the nut to 200 ft-lbs. Spin the wheel at least one full rotation
10. Repeat step #9 two more times
11. Back the nut off until it is loose.


Highly Visible Adjustment Marks
Give mechanics precise control of nut backoff amount during installation.
Infinite Locking Positions
Nut and spring steel keeper mate and lock at any point on the axle spindle in .001" axial increments.

12. Adjust the bearing by tightening the nut to 100 ft-lbs. Spin the wheel at least one full rotation.
13. Repeat step #12 two more times
14. Back the nut off one raised face mark (1/4 turn)
15. Install the keeper with the orange side facing out.
16. Align the flat of the keeper with the milled flat on the spindle and insert the single keeper tab into the undercut groove of the nut. Install the keeper with the orange side facing out.
17. Engage the mating teeth



18. Compress and insert the keeper arms, one at a time, into the undercut groove with a small screwdriver.
19. Verify the end play
20. Attach a dial indicator with a magnetic base to the face of the wheel, hub, or brake drum. The dial indicator may also be attached to the bottom of the brake drum if the wheel is removed.
21. Place the tip of the dial indicator on the center of the steering knuckle spindle. Set the dial indicator on zero.
22. Measure the endplay by simultaneously pushing/pulling on each side of the tire, drum, or hub while observing the dial indicator. The endplay is the total travel observed. If the endplay is not within .001-.005", a readjustment will be required.
23. Install hubcap gasket and hubcap. Tighten the capscrews to **20-30 lbf·ft.** See Torque Table. Replace the hubcap vent plug if removed.
24. Fill the hub cavity with the appropriate amount and type of lubricant and secure drain plug.

25. Check oil level through the hubcap window. (Figure 12). If level is below the “add” level line, then fill with recommended oil until “full” level is achieved. Add oil slowly since the heavy weight oil will settle slowly in the hub. (Note: The hubcap window can only be cleaned with mild soap and water. Aromatic solvents should not be used, as they will impair the transparency of the window.)

26. Check the hubcap for external oil leakage at the drain plug or gasket. For leaks at the drain plug check for application of thread sealant to threads and tightness. For leaks at the gasket, replace the gasket. The vent plug will normally weep a small amount of oil.

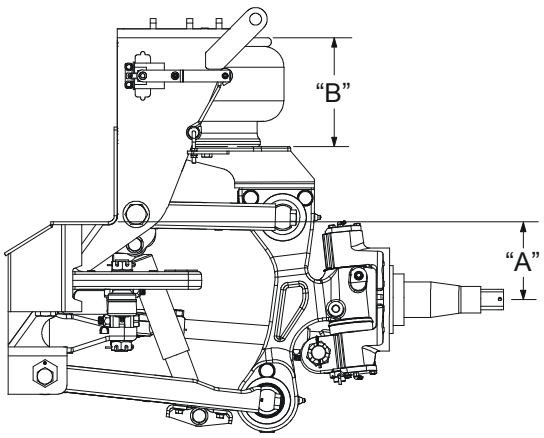
Adjusting Suspension Ride Height

The height control valve (HCV) and linkage should be checked regularly for proper clearance, operation and adjustment.

NOTE

Improperly adjusted ride height will result in incorrect wheel alignment measurements and may result in abnormal tire wear. Check the ride height prior to front suspension alignment.

The ride height of the front suspension is the distance from the bottom of the chassis frame rail to the center of the wheel spindle. An alternate measurement may be taken as the height of the air spring (See Figure 11).



Unit	Ride Height “A”	Air Spring “B”
IFS1660	6.60”	9.25”
IFS1800FT	9.06”	9.25”

Figure 11 – Measurement at Ride Height

Properly adjusted ride height results in correct suspension travel and alignment. The ride height should not be adjusted to adjust chassis rake angle.

⚠ CAUTION

Adjusting the ride height can cause the front end to raise or lower unexpectedly due to vertical movements at the connection of the vertical link and the horizontal arm of the height control valve.

1. Park the vehicle on a level surface.
2. Exhaust or “dump” and re-inflate the air suspension. Allow the Suspension to settle.
3. Check ride height of rear suspension:

A: On vehicles with front suspension equipped with (2) height control valves, check and adjust the rear suspension first.

B: On vehicles with front suspension equipped with a single height control valve, check and adjust the rear suspension after finish adjusting the front.

4. Measure either the wheel center to bottom of frame ("A") or air spring height ("B"). If the dimensions are not within ±1/8" of measurements in Figure 11, adjust as follows.

   A: Loosen the height control valve linkage stud retaining nuts.

   B: Raise or lower the L-shaped linkage stud as necessary.

   C: Tighten the retaining nuts. Note: It is recommended that the upper and lower studs be positioned parallel to each other. Torque to **8-12 lbf·ft**.

5. After adjusting the length, it is recommended to dump and re-inflate the air suspension to obtain the ride height. Allow the suspension to settle.
6. If not already completed, adjust the rear suspension per manufacturer's recommendations.
7. Verify at each axle that the side-to-side ride heights are within .25" of each other.

Adjusting Wheel Bearing Endplay

1. Secure the vehicle by setting the parking brake and block the drive wheels to prevent vehicle movement.

⚠ WARNING

Never work under a vehicle supported by only a jack(s). Jacks can slip or fall over and cause serious personal injury. Always use safety stands. Do not place jacks or safety stands under the lower control arms to support the vehicle. Lower control arms are not stationary components and could move allowing the vehicle drop causing serious personal injury.

27. Raise the vehicle until the front wheels are off the ground. Support the raised vehicle with safety stands.
28. If the tire and wheel are not removed make sure all the wheel nuts are tightened to the specified torque of **450-500 lbf·ft**. See Torque Table.
29. If the tire and wheel are removed (recommended for aluminum wheels) secure the brake drum to the hub with the wheel nuts or remove the brake drum.
30. Place an oil drip tub beneath the hub to catch oil. Rotate the hub such that the hubcap drain plug is facing upwards. Remove the drain plug from the hubcap and place it in a container for re-installation.
31. Rotate the hub such that the drain hole faces downward and drain the oil from hub cavity. Wait a few minutes for most of the oil to drain before continuing to the next step.

32. Remove the hubcap bolts, hubcap, and gasket. Take care not to damage the gasket for re-installation. Place the components in a location to prevent contamination. Note that solvents may damage the hubcap window.

NOTE

When removing or installing the inner and outer spindle nuts, use the correct wrench sockets to avoid damaging the nuts. Do not use impact driver to tighten inner and outer nuts. Only use a torque wrench to tighten the nuts.

33. Remove the cotter pin and loosen the spindle nut.
34. Seat the bearings by tightening the spindle nut to **200 lbf·ft**. while rotating the wheel in both directions.
35. After torquing the castle nut to **200 lbf·ft**. , rotate the hub and rotor ten (10) complete revolutions.
36. Loosen the spindle nut 1/2 turn and then tighten the nut to **50 lbf·ft**.
37. Back off the spindle nut 1/8 turn.
38. Verify that wheel endplay is between .001-.005 inches. (See inspecting wheel endplay section). If not, loosen spindle nut, re-index the spindle nut accordingly, and repeat Steps 9 thru 12 until proper endplay is achieved.
39. Install cotter pin and bend over, if cotter pin hole is not lined up, loosen nut to first locking position.

⚠ CAUTION

Never tighten the spindle nut to align the cotter pin with hole in locking washer. This can pre-load the bearings and cause premature bearing failure.

40. Install hubcap gasket and hubcap. Tighten the capscrews to **20-30 lbf·ft.** See Torque Table. Replace the hubcap vent plug if removed.
41. Fill the hub cavity with the appropriate amount and type of lubricant and secure drain plug.
42. Check oil level through the hubcap window. (Figure 12). If level is below the "add" level line, then fill with recommended oil until "full" level is achieved. Add oil slowly since the heavy weight oil will settle slowly in the hub. (Note: The hubcap window can only be cleaned with mild soap and water. Aromatic solvents should not be used, as they will impair the transparency of the window.)
43. Check the hubcap for external oil leakage at the drain plug or gasket. For leaks at the drain plug check for application of thread sealant to threads and tightness. For leaks at the gasket, replace the gasket. The vent plug will normally weep a small amount of oil.

Adjusting the Maximum Wheel Turn Angle

⚠ CAUTION

Do not adjust maximum wheel turn angle greater than 55°. Mis-adjustment of the wheel turn angle can cause damage to steering system components.

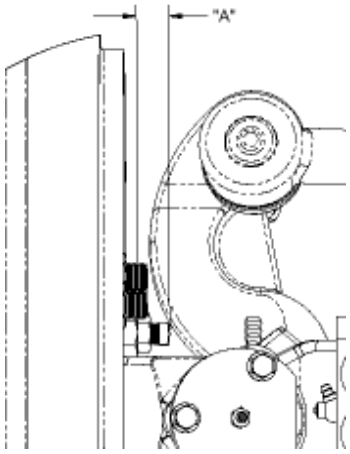
The turn angle may require adjustment if the front tires rub against the frame, suspension, body, or the steering gear has been serviced/replaced. Use an alignment machine to check the wheel turn angle. See the measurement procedure of the alignment machine manufacturer.

The steering stop bolt on the steering knuckle controls the maximum turn angle. If the stop bolt is missing, bent, or broken; replace the stop bolt(s) or jam nut(s) and follow the procedure below for adjustment. Inspect other suspension components for damage.

⚠ CAUTION

In power steering systems, the hydraulic pressure should relieve or "drop off" when the steered wheels approach the steering stops in either direction. If the pressure does not relieve, the components of the front suspension may be damaged.

If the steering stop bolts are adjusted to reduce wheel turn angle, the steering gear poppet valves will require readjustment. If the poppets are not re-adjusted properly, then the steering gear will not reduce power assist properly and steering components will be damaged. Refer to TRW's TAS Steering Gear Service Manual for readjusting the poppets.



Unit	Steering Stop Length "A"
IFS1660	1.38"
IFS1800	1.38"

Figure 13 - Steering Stop Bolt

1. Drive the front tires on a suitable device that allows the front wheels to turn and measures the wheel turn angle.
2. Secure the vehicle by setting the parking brake and block the drive wheels to prevent vehicle movement.

NOTE

Unequal toe-in side to side or an out-of-center steering gear can result in unequal turn angles and steering pull while steering straight ahead. The drag link length may be adjusted to attain steering gear on center condition while maintaining equal toe-in side to side. Do not adjust the length of the drag link or tie rods to center the steering wheel. This can cause the steering gear to become off center.

3. Check that the steering gear is centered and the tires are steered straight ahead with equal toe-in side to side. If either of these two conditions is not met, then adjust toe-in first before centering the steering gear. See Adjusting the Toe-In Section and refer to Spartan chassis service guidelines for centering the steering gear.
4. Check that the lengths of the outer tie rods are equal to each other within 1/8 inch. If not, adjust lengths according to the adjusting the toe-in section before adjusting the steering stops.
5. Turn the steering wheel until the steering stop bolt contacts the knuckle carrier or the steering wheel stops turning. Measure the turn angle of the wheel on the same side as the direction of turn.
6. If the wheel turn angle differs from Spartan chassis guidelines then adjust as follows.
7. Loosen the jam nut on the stop bolt.
8. Turn the stop bolt until the specified wheel turn angle is achieved and the bolt head contacts the knuckle carrier.
9. Tighten the jam nut to **50-75 lbf·ft**. See Torque Table.

⚠ CAUTION

After readjusting the steering stop(s) check that the steering poppets are reset properly and that the front tires do not contact the frame, suspension, or body. Also check that other components are not abnormally contacting one another.

44. Repeat checking and adjustment for turning the opposite direction.

Inspection Before Alignment

See the General Inspection section and check the following before conducting front wheel alignment measurements.

Wheels and Tires

1. Check that the front tires are inflated to the appropriate pressure based on the tire loading.
2. Check that the front tires are the same size and type.
3. Check that all the wheel nuts are tightened to the specified torque of **450-500 lbf·ft**. See Torque Table.
4. Check that the wheel and tire assemblies are balanced.

Front Suspension

1. Check that all fasteners are tightened to the specified torque.
2. Check the suspension ride height and adjust as needed to the specified height.
3. Check for worn ball joints, tie rod ends, steering arm bearings, control arm bushings, knuckle carrier bearings, and damaged suspension components. Replace worn components as needed.
4. Check for loose ball joint and tie rod end tapered connections, tie rod end jam nuts, steering arm mounts, and chassis steering system components. Inspect connections for wear and replace as needed. Tighten connections as needed.
5. Check the wheel bearing adjustment and adjust as needed.

6. Inspect the shock absorbers for wear and damage.

Rear Axle and Suspension

Front tire wear and incorrect steering can be caused by the rear axle and/or suspension.

1. Check that all fasteners are tightened to the specified torque.
2. Check the suspension ride height and adjust as needed to specified height.
3. Check that all connection joints between the suspension and axle are secure.
4. Check for worn suspension bushings or damaged suspension components.
5. Check that the rear axle is correctly aligned.
6. Check that the frame is not bent.
7. Refer to any additional recommendations and specifications from the manufacturer of the chassis on rear axles and suspensions.

NOTE
Total vehicle alignment is recommended when aligning the front suspension.

Front Wheel Alignment

Equipment

Tuthill recommends that suitable alignment equipment be used to measure the wheel alignment characteristics: camber, caster, and toe-in. The alignment equipment must be properly calibrated for accurate measurements. Only qualified personnel should conduct the wheel alignment measurements.

General

The overall toe-in of the front wheels should be checked every 24,000 miles or 2 years. When the vehicle does not steer correctly or the front tires develop an abnormal tire wear pattern, the camber, caster, and toe-in should be measured and adjusted as needed. Toe-in typically has the largest effect on tire wear.

The maximum wheel turn angle should be checked and adjusted as needed.

Eccentric adapters are installed in the lower control arm mounts. The purpose of the adapters is to provide additional adjustment of camber and caster to minimize vehicle drifts or pulls to one side of the road.

The lower bar pin of the knuckle carrier bearing marked with a “B” may also be used to provide additional camber adjustment.

Preparation

1. Follow the alignment equipment manufacturer’s procedures for preparing the vehicle for front and rear wheel alignment measurements.
2. Secure the vehicle by setting the parking brake and block the drive wheels to prevent vehicle movement.

NOTE

An out-of-center steering gear can result in unequal wheel turn angles. The steering gear should remain centered during toe-in adjustment. Do not adjust the length of the drag link or tie rods to center the steering wheel. This can cause the steering gear to become off center.

45. Check that the steering gear is centered when the tires are steered straight ahead (i.e. equal toe-in side to side). Center the steering gear according to Spartan's guidelines.
46. Measure and record the individual wheel camber, caster, and toe-in of the front suspension. Also measure and record the cross camber cross caster, and overall toe-in.
47. If adjustment to camber and caster is required then follow the steps below. Otherwise, go to the "Adjusting the Toe-In" section to adjust the toe-in as needed.

⚠ WARNING

Never work under a vehicle supported by only a jack(s). Jacks can slip or fall over and cause serious personal injury. Always use safety stands. Do not place jacks or safety stands under the lower control arms to support the vehicle. Lower control arms are not stationary components and could move allowing the vehicle drop causing serious personal injury.

48. Raise the vehicle until the front wheels are off the ground. Support the raised vehicle with safety stands.

Adjusting the Camber Angle

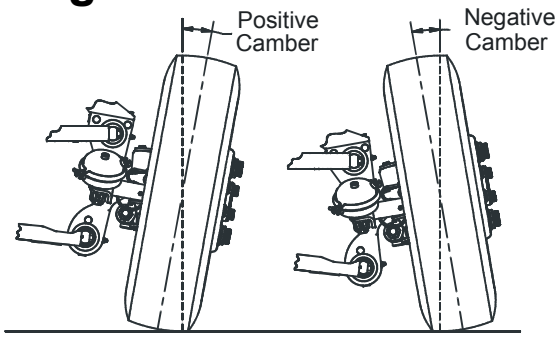


Figure 14 – Camber Angle

⚠ CAUTION

Do not alter components to adjust the camber.

Camber is the angle of the wheel with respect to the ground as viewed from the front or rear of the vehicle (Fig. 14). Camber is positive when the distance between centers of the front wheels at the top is greater than the distance at the ground.

The wheel camber angle is affected by the ride height of the suspension. If the ride height is set too high, then the camber measurement will be more positive. See the inspecting and adjusting suspension ride height sections before measuring camber. The table below lists the recommended camber angles.

Nominal Camber Values-Degrees		
	Unloaded	Loaded
Left	+1/4°(±1/4°)	+1/4°(±1/4°)
Right	+1/4°(±1/4°)	+1/4°(±1/4°)

Eccentric Camber Adjustment

The setscrew in the eccentric adapter denotes the orientation of the eccentricity of the adapter. When the setscrew is in the 6 o'clock or 12 o'clock position, then the adapter is in the "neutral" position. There are two adapters at each lower control arm mount and they must be oriented the same.

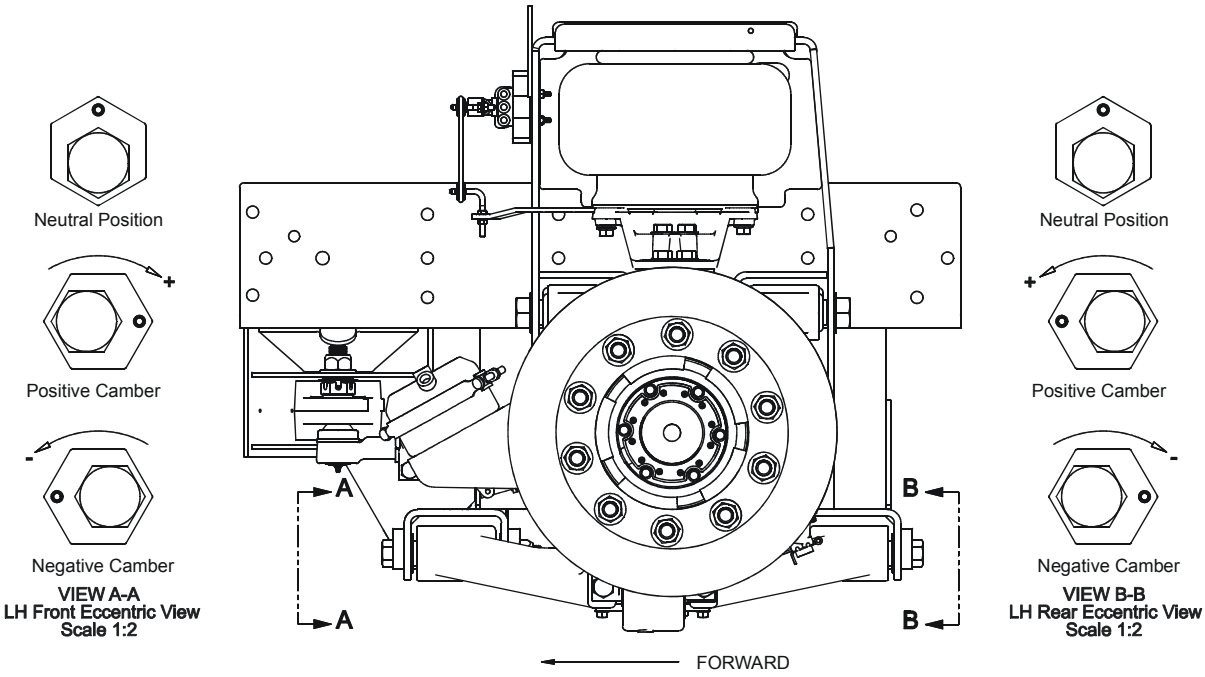


Figure 15 – Eccentric Camber Adjustment

When the setscrews in both lower control arm mounts are oriented closer to the suspension centerline, the tire camber becomes more negative. When the setscrews in both control arm mounts are oriented farther from the suspension centerline, the tire camber becomes more positive (Fig. 15). The eccentric adapters at both lower control arm mounts must be oriented the same to affect only camber.

1. Loosen both lower control arm mounting bolts at the eccentric adapters. Do not remove the bolts because the adapters must remain engaged in control arm mounting plate for adjustment.
2. Loosen the setscrews.
3. Rotate each eccentric adapter to the same orientation as needed based on measured wheel camber. The eccentric adapters at each control arm mount must have the same orientation.
4. Tighten the adapter locknuts to **460-490 lbf·ft**. See Torque Table.
5. Tighten the setscrews to **30-40 lbf·in**. See Torque Table.
6. Remove the jack stands and lower vehicle completely. Check that the suspension is at the proper ride height.
7. Re-measure the camber and readjust as needed.

Bar Pin Camber Adjustment

The lower bar pin of the knuckle carrier bearing marked with a "B" on the end is configured such that it can be re-oriented

to provide camber adjustment. Lower bar pins are factory installed with the "B" located closest to the lower control arm. The wheel camber becomes more positive when the lower bar pin is re-oriented such that the "B" is located farthest from the lower control arm.

1. Place a portable jack under the tire to secure and support it.

⚠ CAUTION

Do not remove both upper and lower knuckle carrier mounting bolts at the same time. The knuckle carrier must be secured and supported properly if both upper and lower mounting bolts are removed.

NOTE

Lower control arm may move downward due to the internal gas charge in the shock absorber. A portable jack may be needed to align the lower control arm with the knuckle carrier bar pin.

2. Remove the bottom knuckle carrier mounting bolts from the lower control arm. Heat may need to be applied to the control arm to loosen the thread adhesive. The control arm temperature must not exceed 300°F. Do not apply heat directly to the bar pin or mounting bolts.
3. Raise the jack to separate the bar pin from the control arm and re-orient it.
4. Lower the jack to align the bar pin with the control arm. Apply Loctite #271 to mounting bolt threads and tighten to **275-300 lbf·ft**. See Torque Table.

Adjusting the Caster Angle

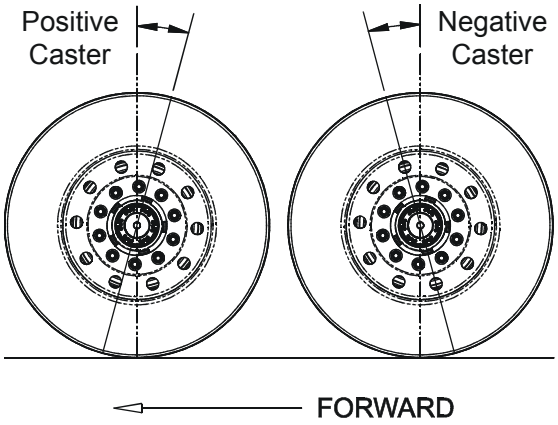


Figure 16 – Caster Angle

⚠ CAUTION

Do not adjust the suspension ride height or alter components to adjust the caster.

The caster angle is the angle between a vertical axis and the axis defined by the king pin when viewed from the side of the vehicle. When the king pin axis appears rotated clockwise relative to the vertical axis, then the caster is positive. Positive caster creates a self-aligning moment to stabilize the vehicle when driving straight ahead (Figure 16).

The caster angle is indirectly measured from the change in wheel camber as the wheel is turned through a prescribed turn angle. Therefore, the calculated caster is affected by the ride height of the suspension. See the inspecting and adjusting suspension ride height sections before measuring caster. The table below lists the recommended caster angles.

Nominal Caster Values-Degrees		
	Unloaded	Loaded
Left	+3°(±1/2°)	+3°(±1/2°)
Right	+3°(±1/2°)	+3°(±1/2°)

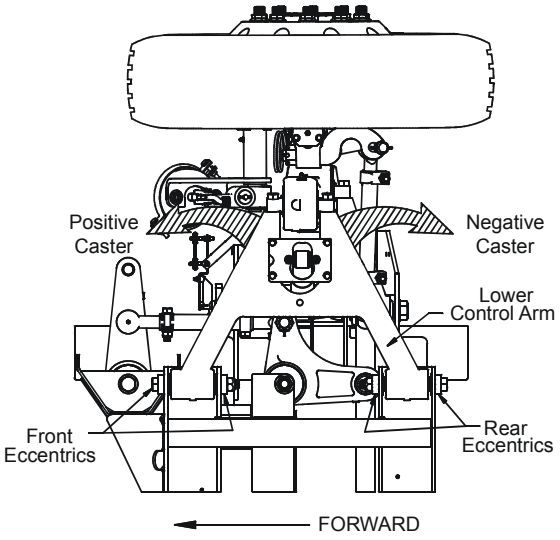


Figure 17 – Lower control arm movement

Eccentric Caster Adjustment

The setscrew in the eccentric adapter denotes the orientation of the eccentricity of the adapter. When the setscrew is in the 6 o'clock or 12 o'clock position, then the adapter is in the "neutral" position. There are two adapters at each lower control arm mount and they must be oriented the same.

When the setscrews in the forward lower control arm mount are oriented closer to the frame rail and the setscrews in the rearward lower control arm mount are oriented farther from the frame rail, the caster becomes more negative (Fig. 18).

When the setscrews in the forward lower control arm mount are oriented farther from the frame rail and the setscrews in the rearward control arm mount are oriented closer to the frame rail, the caster becomes more positive.

The eccentric adapters at both lower control arm mounts must be oriented opposite each other to affect caster.

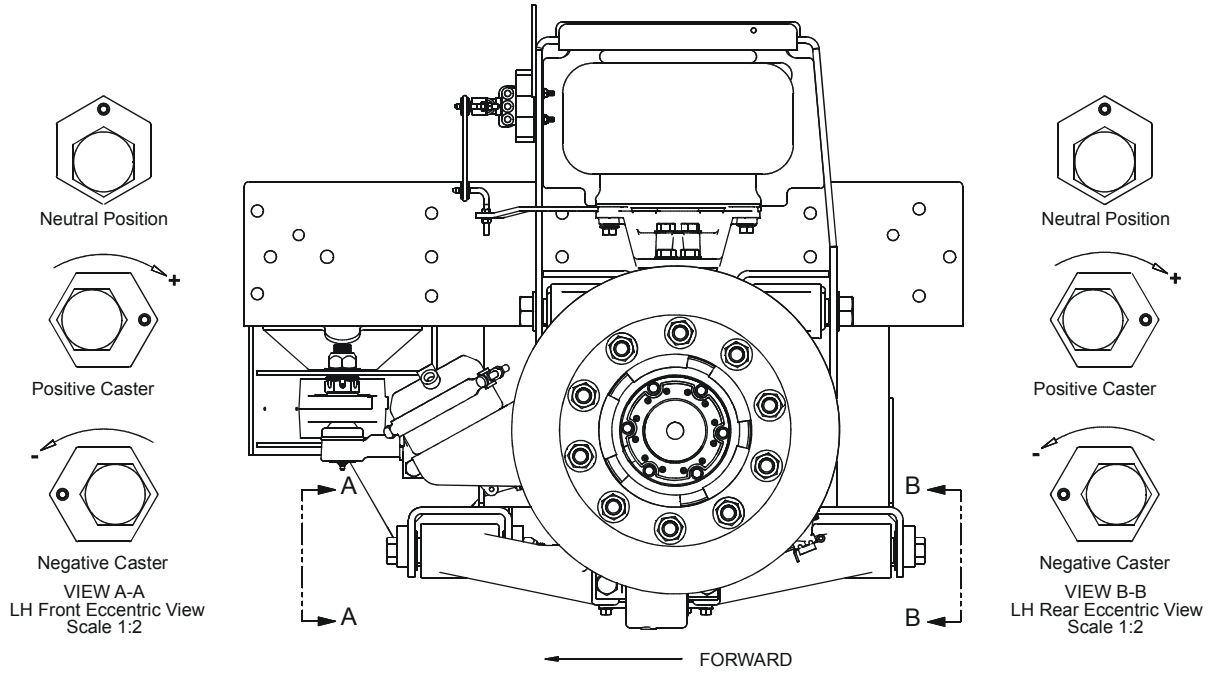


Figure 18 – Eccentric Caster Adjusment

1. Loosen both lower control arm mounting bolts at the eccentric adapters. Do not remove the bolts because the adapters must remain engaged in control arm mounting plate for adjustment.
2. Loosen the setscrews.
3. Rotate the eccentric adapters at the forward and rearward control arm mounts opposite one another as needed based on measured wheel caster. The eccentric adapters at each control arm mount must have the same orientation.
4. Tighten the adapter locknuts to **460-490 lbf·ft.** See Torque Table.
5. Tighten the setscrews to **30-40 lbf·in.** See Torque Table.
6. Remove the jack stands and lower vehicle completely. Check that the suspension is at the proper ride height.
7. Re-measure caster and readjust as needed.

Adjusting the Toe-In

⚠ CAUTION

Do not alter components to adjust the toe-in.

⚠ CAUTION

Improperly oriented tie rod clamps can cause binding in the suspension steering system.

Wheel toe-in is the relationship of the distance between the centers of the front and rear of the front wheels. When the front distance is less than the rear distance, the wheels are “toed-in”. Toe-in is designed into the suspension to counteract the tendency of the tires to toe-out when the vehicle is driven straight ahead. Incorrect toe-in can result in rapid tire wear.

1. Measure the length of the outer tie rods. Reference length is 17 inches.
2. If the lengths of the outer tie rods are not within 1/8 inch of each other, then adjust their lengths such that they are within 1/8 inch of each other. Loosen the tie rod clamps on each end of the tie rod and turn the center tube to change the length.
3. Adjust the length of both outer tie rods equally such that the toe-in on each side is 1/16” ± 1/32” and the over all toe-in is 1/8” ± 1/16”. Tighten tie rod clamp nuts to **50-60 lbf·ft.** See Torque Table. Refer to Figure 6 for tie rod clamp orientation.

General Procedures

Repair or reconditioning of front suspension components is not allowed. Components that are damaged or worn must be replaced. Several major components are heat treated and tempered.

⚠ WARNING

The components cannot be bent, welded, heated altered, or repaired in any way without reducing the strength or life of the component and voiding the warranty.

The following operations are prohibited on front suspension components.

1. Welding of or to the steering knuckles, control arms, steering arms, knuckle carrier, tie rod assemblies, the brakes, the hubs, and the brake drums.
2. Hot or cold bending of the steering knuckles, control arms, steering arms, knuckle carrier, tie rod assemblies, ball joints, and the subframe except control arm and steering arm mounts which may be cold bent to facilitate bushing and bearing replacement.
3. Drilling out control arm and steering arm mounting holes and ball stud tapered holes.
4. Spray welding of bearing diameters on the steering knuckle spindle, steering arm bores and pivot tube. Spray welding of ball studs or tapered holes for the ball joint and tie rod ends.

    49. Milling or machining of any component except that control arm bushing bores may be honed to remove any burrs.

⚠ WARNING

Never work under a vehicle supported by only a jack(s). Jacks can slip or fall over and cause serious personal injury. Always use safety stands. Do not place jacks or safety stands under the lower control arms to support the vehicle. Lower control arms are not stationary components and could move allowing the vehicle drop causing serious personal injury.

The vehicle may be supported on safety stands by the suspension subframe or chassis frame for repairs that require removal of the wheel and tires or deflation of the air springs. Always secure the vehicle by setting the parking brake and block the drive wheels to prevent vehicle movement before performing repairs.

Cleaning the Parts

⚠ WARNING

If you use cleaning solvents, hot solution tanks or alkaline solutions incorrectly, serious personal injury can occur. To prevent injury, follow the instructions supplied by the manufacturer. Do NOT use gasoline to clean parts. Gasoline can explode.

Ground or Polished Parts

Use a cleaning solvent to clean ground or polished parts and surfaces. DO NOT clean ground or polished parts with hot solution tank or with water, steam or alkaline solutions. These solutions will cause corrosion of the parts.

Rough Parts

Rough parts can be cleaned with the ground and polished parts. Rough parts also can be cleaned in hot solution tanks with a weak alkaline solution. Parts should remain in the hot solution tanks until they are completely cleaned.

Drying

Parts must be dried immediately after cleaning. Dry parts with clean paper or rags, or compressed air. Do not dry bearings by spinning with compressed air.

Preventing Corrosion

Apply light oil to cleaned and dried parts that are not damaged and are to be immediately assembled. Do NOT apply oil to the brake linings or the brake drums. If the parts are to be stored, apply a good corrosion preventative to all surfaces and place them inside special paper or containers that prevent corrosion. Do NOT apply corrosion preventative to the brake linings or the brake drums/rotors.

Replacing Tie Rod Ends

Removal

1. Remove the cotter pins from the tie rod end ball stud(s).
2. Remove the castle nuts from the tie rod end ball stud(s).

⚠ CAUTION

Do not strike the component mating taper directly with a steel hammer. Parts can break and cause serious personal injury. Wear eye protection.

3. Disconnect the tie rod end ball stud from the mating component tapered hole using a suitable tool.
50. Inspect the tie rod end ball stud and mating component tapered hole(s). Replace components with worn tapered hole(s). If the grease seal is damaged during removal, replace it before installation.

Installation

1. Clean the mating component tapered hole(s) of any contamination. Insert the tie rod end ball stud into the tapered hole and secure it with the castle nut.

⚠ CAUTION

Tighten the castle nuts to the specified torque. If the castle nuts are not tightened to the specified torque, the parts will be damaged and serious personal injury may occur.

51. Tighten the castle nut to **90-100 lbf·ft**. See Torque Table.
52. Install the cotter pins. If necessary, tighten the castle nut to align the hole in the ball stud and slots in the castle nut. Do not loosen the castle nut to install the cotter pin.
53. Lubricate tie rod end as needed.

Replacing the Steering Arm Ball Joints

The thread-in mount type ball joints are installed with a thread adhesive and may require the threads to be warmed to ease removal. If heat is applied to the ball joint threads, the steering arm temperature must not exceed 300°F and the heat should be applied at the bottom of the ball joint base only. Applying heat to the ball joint will damage the ball joint by destroying its internal components as well as the external seal permanently, degrading the lubricant, and restricting ball stud movement.

It is recommended that the appropriate tools be used to remove the ball stud taper from the relay rod and to remove the ball joint base from the steering arm.

Removal

1. Remove the cotter pins from the ball joint ball stud(s).
2. Remove the castle nuts from the ball joint ball stud(s).

⚠ CAUTION

Do not strike the component mating taper directly with a steel hammer. Parts can break and cause serious personal injury. Wear eye protection.

54. Disconnect the ball joint ball stud from the steering arm tapered hole using a suitable tool.
55. Secure the steering arm and remove the ball joint using a ball joint spanner wrench or similar device on the base. Steering arm may be removed to facilitate ball joint removal. See the steering arm replacement section as needed.
3. Inspect the ball joint stud and relay rod tapered hole(s). Replace relay rod if tapered hole(s) is worn.

Installation

1. Clean the threaded hole in steering arm of any contamination.
2. Apply thread adhesive Loctite #242 to the ball joint base threads and thread it into the steering arm by hand.
3. Tighten the base of the ball joint to **325-375 lbf·ft**. See Torque Table.
4. Clean the relay rod tapered hole(s) of any contamination. Insert the ball joint stud into the tapered hole and secure it with the castle nut.

⚠ CAUTION

Tighten the castle nuts to the specified torque. If the castle nuts are not tightened to the specified torque, the parts will be damaged and serious personal injury may occur.

56. Tighten the castle nut to **155-170 lbf·ft**. See Torque Table.
57. Install the cotter pins. If necessary, tighten the castle nut to align the hole in the ball stud and slots in the castle nut. Do not loosen the castle nut to install the cotter pin.

Replacing the Bell Crank, Idler, and Crank Steering Arm Bearings

Replace the bell crank, idler, and crank steering arm bearings in sets. The replacement bearings should be installed

by pressing on the outer raceway only. Pressing on the inner raceway will damage the bearing.
The inner grease cavity of the steering arms should be cleaned when the bearings are replaced.

Removal

1. Follow the procedures for removal of the relay rod from the ball joint in the bell crank and idler steering arm.
2. Follow the procedures for removal of tie rod ends for the crank steering arm.
3. Remove the pivot bolt that mounts the steering arm and remove the steering arm from the subframe.
4. Remove the retaining rings from the pivot sleeve and remove the sleeve. A rubber or brass hammer may be used to remove the sleeve. Retain shims.
5. Support the steering arm bearing housing and press the bearing out of each end of the steering arm.

Installation

1. Clean out the steering arm grease cavity.
2. Inspect steering arm bearing housing bores and remove burrs by honing. Replace steering arm if the bore is damaged.
3. Pack the steering arm bearing with grease.
4. Support the steering arm bearing housing and press the bearing into each end of the steering arm. Note that the seal side of the bearing should face out.
5. Inspect the pivot sleeve and remove burrs with emery cloth.
6. Install one retaining ring onto pivot sleeve.
7. Insert the pivot sleeve into the lower bearing. Use a rubber mallet or similar tool to drive the inner sleeve into the bearings such that the bottom-retaining ring is seated against the bottom inner race. Do not use a steel hammer to install the sleeve because bearing raceways can be damaged.
8. Install upper retaining ring. Reseat lower retaining ring against the lower inner race as needed.
9. Determine the number of shims needed by stacking the shims and placing the stack between the upper retaining ring and inner race until a snug fit is achieved. Remove one shim from the stack and this is the number of shims needed. A maximum of six shims may be used.
10. Remove the upper retaining ring, install the shims determined in step 9 onto the inner sleeve at upper inner race, and re-install the upper retaining ring. Check that upper retaining ring is properly seated in the groove of the inner sleeve.
11. Place the steering arm in its mount and install the pivot bolt. Tighten the pivot bolt lock nut to **575-625 lbf·ft.** See Torque Table.
12. Follow the procedures for installation of the relay rod or tie rod.

Replacing the Upper and Lower Control Arm Bushings

The subframe control arm mounts may require widening to accommodate replacement bushings. A suitable jack may be used to increase the width of the control arm mounts by cold bending. Care must be taken to not exceed 5.00” width after

widening. The control arm mounts should be inspected for damage.

Both control arm bushings and mounting hardware except eccentric adapters must be replaced in a control arm when bushings are serviced. It is recommended to replace the control arm bushings and mounting fasteners in all of the control arms at the same time.

The control arm housings must be properly supported during bushing removal. The bores of the control arm housings may be honed to remove any burrs.

⚠CAUTION

Use of a cutting torch to remove control arm bolts will permanently damage control arm bushings and can result in damage to subframe.

It is recommended that the wheel and tire be removed to provide proper accessibility. Disconnect the vertical height control valve linkage from the horizontal arm to prevent unintentional inflation of the air spring.

Upper Control Arm Removal

1. Place a portable jack under the knuckle carrier to secure and support it.

⚠CAUTION

Do not remove both upper and lower knuckle carrier mounting bolts at the same time unless the knuckle carrier is properly secured.

2. Remove knuckle carrier mounting bolts from the control arm. Heat may need to be applied to the control arm to loosen the thread adhesive. The control arm temperature must not exceed 300°F. Do not apply heat directly to the bar pin or mounting bolts.
3. Disconnect sway bar connector at sway bar if so equipped with a sway bar.
4. Loosen and remove control arm mounting locknuts.
5. Support control arm and remove control arm mounting bolts. Remove the control arm.
6. Remove the sway bar bracket and linkage from the control arm and retain for installation.
7. Press the bushings out of the housings. Support the housing properly.

Upper Control Arm Installation

1. Inspect the housing bores and remove any burrs in the housing bores by honing.
2. Press the bushings into the housings using a suitable tool to apply pressure to only the outer metal of the bushing. Support the housing properly.
3. Re-install the sway bar bracket and linkage if removed.
4. Place the control arm in its mount location. Install the control arm mounting hardware and tighten snugly.
5. Orient the control arm at suspension ride height and tighten the bolts to **950-1050 lbf·ft.** See Torque Table.
6. Reconnect the sway bar linkage. Tighten mounting bolt to **75-85 lbf·ft.** See Torque Table.

7. Apply Loctite #271 to mounting bolt threads and tighten to **350-375 lbf·ft**. See Torque Table.

Lower Control Arm Removal

1. Place a portable jack under the knuckle carrier to secure and support it.

⚠CAUTION

Do not remove both upper and lower knuckle carrier mounting bolts at the same time unless the knuckle carrier is properly secured.

NOTE

Lower control arm may move downward due to the internal gas charge in the shock absorber. A portable jack may be needed to align the lower control arm with the knuckle carrier bar pin.

2. Remove knuckle carrier mounting bolts from the control arm. Heat may need to be applied to the control arm to loosen the thread adhesive. The control arm temperature must not exceed 300°F. Do not apply heat directly to the bar pin or mounting bolts.
3. Note orientation of lower bar pin in carrier bearing. Raise the jack as needed to separate the bar pin from the control arm.
4. Remove and retain the lower shock bar pin mounting hardware. Shock will extend due to internal gas charge. Rotate bar pin to provide clearance with mounting bracket.
5. Note orientation of eccentric adapters for installation.
6. Loosen and remove control arm mounting locknuts.
7. Support control arm and remove control arm mounting bolts. Retain eccentric adapters for installation. Remove the control arm.
8. Remove spacer tubes from bushings and retain for installation.
9. Press the bushings out of the housings. Support the housing properly.

Lower Control Arm Installation

1. Inspect the housing bores and remove any burrs in the housing bores by honing.
2. Press the bushings into the housings using a suitable tool to apply pressure to only the outer metal of the bushing. Support the housing properly.
3. Install the spacer tubes in bushings.
4. Place the control arm in its mount location. Install the control arm eccentric adapters and mounting hardware and tighten snugly. Orient the eccentric adapters the same as before removal.
5. Orient the control arm at suspension ride height and tighten the bolts to **460-490 lbf·ft.** See Torque Table.
6. Note orientation of bar pin in carrier bearing. Lower the jack to align the bar pin with the control arm.
7. Apply Loctite #271 to mounting bolt threads and tighten to **350-375 lbf·ft**. See Torque Table.
8. Compress shock absorber and connect the lower bar pin mount to the lower shock bracket using the mounting hardware. Tighten the nuts to **30-40 lbf·ft**. See Torque Table.

Replacing Wheel Bearings, Oil Seals, and Hub Caps

If the wheel nuts have chrome covers, remove them with special pliers equipped with plastic non-marring jaws. Place them in a container to prevent damage or loss.

On aluminum wheels, place a plastic anti-scuff guard over the wheel nuts and loosen the wheel nuts. On steel wheels, remove the wheel hubcap nuts if present and the wheel hubcap before loosening the wheel nuts. Place the wheel hubcap in safe location to prevent damage. Place the wheel and/or wheel hubcap nuts in a container to prevent contamination or loss.

Remove the wheel and tire assembly and place it aside. Mark the tire to ensure it can be identified for installation on same side as removed. Remove the brake rotor assembly and place it aside. Mark the rotor assembly to ensure it can be identified for installation on same side as removed.

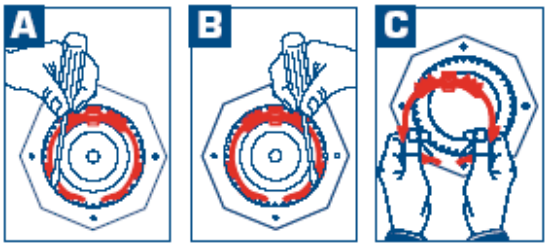
Removal

1. Place an oil drip tub beneath the hub to catch oil. Rotate the hub such that the hubcap drain plug is facing upwards. Remove the drain plug from the hubcap and place it in a container for re-installation.
2. Rotate the hub such that the drain hole faces downward and drain the oil from hub cavity. Wait a few minutes for most of the oil to drain before continuing to the next step.
3. Remove the hubcap bolts, hubcap, and gasket. Take care not to damage the gasket for re-installation. Place the components in a location to prevent contamination. Note that the hub cap window may be damaged by solvents.

NOTE

When removing or installing the outer spindle nut, use the correct wrench sockets to avoid damaging the nuts. Do not use impact driver to tighten outer nut. Only use a torque wrench to tighten the nuts.

4. Remove the keeper from the nut.



5. A, B, C Use a small screwdriver to carefully pry the keeper arm from the undercut groove on each side until the keeper is released.
6. Remove the retaining nut
7. Place a shop towel on top of the lower brake shoe to prevent oil from dripping onto the brake lining.
8. Tug sharply on the hub to unseat the outer bearing without completely removing the hub. Wipe up any oil spilled on the brake assembly as quickly and completely as possible. Remove the outer bearing and place it in a container to prevent contamination.

9. Remove the hub from the spindle and place it on the floor with its stud side facing downwards. Protect the wheel studs from damage. Wipe the excess oil off spindle with a clean shop towel to prevent oil dripping onto the brake assembly. If oil saturates or significantly contaminates the brake lining then replace the lining.
10. Remove the hub seal and discard it. Remove the wear ring from the spindle and discard it.
11. Inspect the inner cup (outer bearing race for the inner bearing) and outer cup in the hub for damage. Replace the bearing cups if worn or damaged.
12. Inspect the bearing areas on the spindle for wear or damage. Burrs may be removed by light application of emery cloth. Replace steering knuckle if the spindle is damaged.

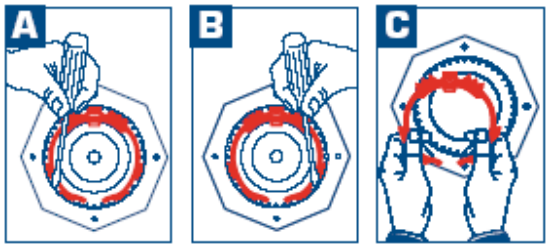
Installation

1. Place the hub seal assembly with axle ring onto the spindle so the words "Oil Bearing Side" face outboard. Do not place the seal in the hub bore.
2. Drive the seal onto the spindle using the appropriate seal installation tool and a 3-5lb hammer. (Reference Stemco P/N 0155220) The wear ring is fully seated when it is square and flush with the face of the inner bearing shoulder of the spindle. Reseat the seal onto the wear ring if it becomes dislodged after seating.

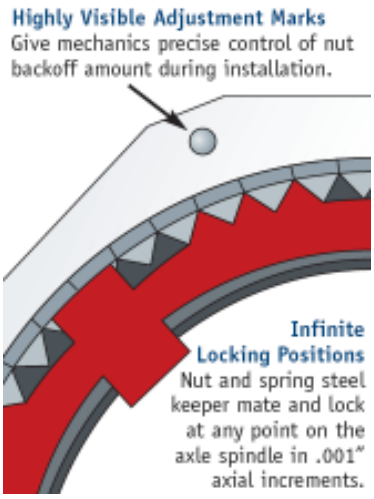
NOTE

t drive bearings onto the spindle with a steel hammer or similar instrument. Bearing inner race is a tight slip fit with spindle.

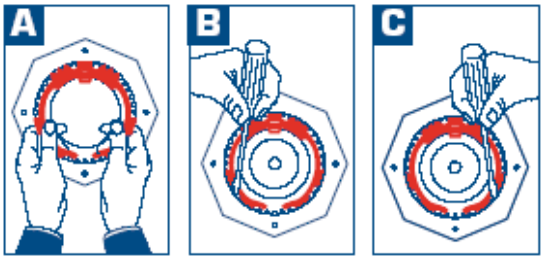
3. Pre-lube the inner bearing and place it onto spindle with small end of taper facing outward. Seat the inner race against the shoulder of the spindle.
4. Press the ABS sensor outward about ¼". Do not use a sharp tool on lead wire end of the sensor. See section for the inspection of ABS sensor as needed.
5. Place the hub onto the spindle until it seats on the inner bearing. Do not "ram" the hub onto the seal.
6. Pre-lubed outer bearing and place it onto the spindle until it seats on the outer cup in the hub. The bearing retaining washer may be used to guide the bearing onto the spindle. The hub should be supported to prevent misalignment and binding.
7. Remove the keeper from the nut.



8. A, B, C Use a small screwdriver to carefully pry the keeper arm from the undercut groove on each side until the keeper is released.
9. Seat the bearing, with the hub or hub and drum only using a torque wrench.
10. Tighten the nut to 200 ft-lbs. Spin the wheel at least one full rotation
11. Repeat step #9 two more times
12. Back the nut off until it is loose.


Highly Visible Adjustment Marks
Give mechanics precise control of nut backoff amount during installation.
Infinite Locking Positions
Nut and spring steel keeper mate and lock at any point on the axle spindle in .001" axial increments.

13. Adjust the bearing by tightening the nut to 100 ft-lbs. Spin the wheel at least one full rotation.
14. Repeat step #12 two more times
15. Back the nut off one raised face mark (1/4 turn)
16. Install the keeper with the orange side facing out.
17. Align the flat of the keeper with the milled flat on the spindle and insert the single keeper tab into the undercut groove of the nut. Install the keeper with the orange side facing out.
18. Engage the mating teeth



19. Compress and insert the keeper arms, one at a time, into the undercut groove with a small screwdriver.
20. Refer to the Wheel Bearing Endplay Adjustment section to measure and adjust the endplay to .001-.005 inch. Adjust by loosening spindle nut, re-indexing the spindle nut accordingly, and repeat Steps 8 thru 19 until proper endplay is achieved.
21. Install hubcap gasket and hubcap. Tighten the capscrews to **20-30 lbf·ft.** See Torque Table. Replace the hubcap vent plug if removed.
22. Fill the hub cavity with the appropriate amount and type of lubricant and secure drain plug.
23. Check oil level through the hubcap window. (Figure 20). If level is below the "add" level line, then fill with recommended oil until "full" level is achieved. Add oil slowly since the heavy weight oil will settle slowly in the hub. (Note: The hubcap window can only be cleaned with mild soap and water. Aromatic solvents should not be used, as they will impair the transparency of the window.)

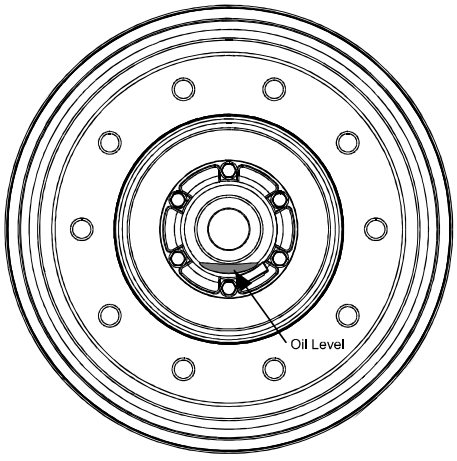


Figure 20 - Wheel Bearing Oil Level

24. Check the hub cap for external oil leakage at the drain plug or gasket. For leaks at the drain plug check for application of thread sealant to threads and tightness. For leaks at the gasket, replace the gasket. The vent plug will normally weep a small amount of oil.
25. Install the brake drum.
26. Install the wheel and tire assembly and the wheel nuts.
27. On aluminum wheels, use a plastic anti-scuff guard over the wheel nuts. Tighten the wheel nuts to **450-500 lbf·ft**. See Torque Table for sequence.
28. Replace the wheel hubcap nuts and hubcaps if removed to service the wheel bearings.

Replacing Brake Components

Brake Drums

The brake drums should be replaced if they are damaged or exceed the drum manufacturers recommended maximum diameter or runout specification. Refer to manufacturer brake drum guidelines for inspection and specifications.

Automatic Slack Adjuster

The automatic slack adjusters are not serviceable and should be replaced if damaged or malfunctioning. Refer to manufacturer guidelines for correct function of the automatic slack adjuster.

Brake Chambers

The brake air chambers should be replaced if damaged or malfunctioning. Refer to manufacturer guidelines for correct function of the brake air chambers.

Other Brake Components

The brake shoe linings should be replaced when they are worn beyond the manufacturers limits. When the brake linings are serviced, other components such as the S-cam rollers and return springs should also be serviced. Refer to the brake manufacturers guidelines for servicing the brakes.

Replacing the ABS Sensor and Tone Ring

The anti-lock brake system (ABS) of the vehicle should be diagnosed by a qualified technician before the anti-lock brake sensor or the tone ring are replaced. Replacement parts must be equivalent to the vehicle manufacturers to ensure proper function of the anti-lock brake system. The anti-lock brake sensor and tone ring cannot be repaired and must be replaced if damaged or malfunctioning.

Sensor Removal

1. Remove the brake drum to provide access to sensor.
2. Press sensor out of steering knuckle. Do not pull sensor out by its lead wire.
3. Remove tie straps that secure the sensor lead wire and disconnect the sensor lead wire from the chassis wire harness.

Sensor Installation

1. Check that the sensor bushing is properly seated in the steering knuckle and the sensor spring retainer is seated properly in the sensor bushing.
2. Press the sensor into the steering knuckle until the sensor end contacts the tone ring.

3. Connect a volt meter to the connector pins of the sensor lead wire. Set the volt meter to read AC voltage on a scale of 1-10V.
4. Spin the hub by hand and read the voltage output of the sensor. A minimum reading of .8V AC is normal. Skip to step 8 if minimum reading is obtained.
5. If the minimum reading is not obtained then check the volt meter connection and proximity of the sensor and tone ring. The air gap between the sensor and tone ring should not exceed .027". Repeat step 4.
6. If the minimum reading is not obtained, check the tone ring for damage and its installation. The tone ring should have a maximum runout of .008". Replace as needed and repeat step 4.
7. If the minimum reading is still not obtained, then replace the sensor and repeat the installation procedure.
8. Route and secure the sensor lead wire the same as the removed sensor.
9. Connect the sensor lead wire to the chassis. Secure wire lead to prevent damage during suspension movement.

Tone Ring Removal and Installation

Follow the hub manufacturers guidelines for removal and installation of the tone ring.

Replacing the Shock Absorber

⚠ CAUTION

The shock absorber is gas pressurized and must not be punctured or be subjected to excessive heat which can result in serious personal injury. The shock will expand to its full extended length if not restrained.

Removal

1. Remove the thru bolt on and retain for installation. Do not remove lower shock mount bracket from lower control arm.
2. Remove upper shock bushing mounting hardware and retain for installation.

Installation

1. Position shock in suspension such that the thru bolt is connected to the lower shock mounting bracket tabs.
2. Attach upper shock bushing to suspension subframe with mounting hardware. Do not tighten.
3. Tighten lower thru mounting bolt and nut to **170-190 lbf·ft.** See Torque Table Tighten nuts to **30-40 lbf·ft.** See Torque Table.
4. Tighten upper mounting nut to **170-190 lbf·ft.** See Torque Table.

Replacing the Air Spring

The correct air spring must be installed. The use of a substitute air spring is not allowed and may cause unequal load sharing between the air springs and cause adverse ride and handling characteristics.

Removal

1. Deflate the air spring by disconnecting one end of the vertical HCV linkage from the horizontal arm. Rotate the horizontal HCV arm downward and secure it in place.
2. Disconnect the airline at the air spring inlet port and remove the connection fitting from the inlet port.
3. Remove the bolts and washers from the upper air spring mount studs. Note location of bolts and washers.
4. Remove the bolts that secure the air spring to the lower air spring mount.

Installation

1. Attach air spring to upper air spring mount. Note that the shorter bolt is located towards the front. Tighten mounting hardware snugly.
2. Attach air spring to lower air spring mount. Tighten lower mounting bolts to **20-30 lbf·ft**. See Torque Table.
3. Tighten the upper mounting bolts to **20-30 lbf·ft**. See Torque Table.
4. Apply Permatex or equivalent thread sealant to the threads of the air connection fitting and install the fitting.
5. Connect the airline to the fitting.
6. Inflate the air spring by un-securing the HCV horizontal arm and reconnecting the vertical linkage to it.
7. Check the airline and fitting for air leaks.

Replacing the Height Control Valve

The correct height control valve (HCV) must be installed. The use of a substitute HCV is not allowed and may cause unequal load sharing between the air springs and cause adverse ride and handling characteristics.

Removal

1. Drain the air from the supply reservoir on the chassis connected to the front suspension.
2. Disconnect the vertical HCV linkage from the horizontal arm.
3. Mark airlines and connections for re-assembly. Disconnect the airlines from the HCV. If any other plumbing fixtures are connected to the HCV, mark them for re-assembly.
4. Remove the HCV mounting hardware from the subframe.
5. Remove any other air fittings or plumbing fixtures from the HCV.

Installation

1. Apply Permatex or equivalent thread sealant to the threads of the air connection fittings or plumbing fixtures and install the fittings or plumbing fixtures in the HCV.
2. Attach the HCV to the subframe with mounting hardware. Orient the horizontal arm horizontally and tighten the mounting nuts to **7-9 lbf·ft**. See Torque Table.
3. Connect airlines as marked during removal.
4. Connect the vertical linkage to the horizontal arm.
5. Recharge system with air and check for air leaks.

6. Check the ride height and adjust per section on adjusting the ride height as needed.

Replacing the Sway Bar and Components

It is recommended that the sway bar mounting bushings and the vertical linkages be replaced all at the same time.

Vertical Linkage Removal

1. Disconnect sway vertical linkage at upper control arm bracket on both sides. Retain hardware for installation.
    1. Secure the sway bar to prevent rotation and disconnect the lower connection to the sway bar on both sides.

Vertical Linkage Installation

1. Attach the sway bar vertical linkage to the upper and lower mounts.
2. Tighten the mounting nuts to **80-90 lbf·ft**. See Torque Table.

Sway Bar Removal

1. Follow the instructions for removal of the sway bar vertical linkage for both sides.
2. Remove mounting hardware from “D” ring sway bar mounts on rear of suspension subframe. Retain hardware for installation.
3. Remove the “D” rings and bushings from the sway bar.

Sway Bar Installation

1. Replace the “D” ring bushings.
2. Apply TC 1920 Aqua Shield Grease to the inside of the bushing. Attach the “D” rings and bushings to the sway bar in the same location as removal.
3. Attach the sway bar to the subframe using the mounting hardware.
4. Tighten the mounting nuts to **52 lbf·ft**. See Torque Table.
5. Follow the instructions for installation of the sway bar vertical linkage for both sides.

Replacing the Steering Knuckle Carrier Bearings

It is recommended to replace all the steering knuckle carrier bearings at the same time.

The wheel and tire should be removed to provide access. The steering knuckle may be removed to provide easier handling of steering knuckle carrier assembly.

⚠ CAUTION

The knuckle carrier must be secured and supported properly when upper and lower mounting bolts are removed.

Removal

1. Note installed orientation of the upper and lower bar pin. Lower bar pins are factory installed with the “B” located closest to the lower control arm.

⚠ CAUTION

Do not apply excessive preload to bearings.

NOTE

Lower control arm may move downward due to the internal gas charge in the shock absorber. A portable jack may be needed to align the lower control arm with the knuckle carrier bar pin.

2. Remove the steering knuckle carrier mounting bolts from the upper and lower control arms. Heat may need to be applied to the control arm to loosen the thread adhesive. The control arm temperature must not exceed 300°F. Do not apply heat directly to the bar pin or mounting bolts.
3. Remove steering knuckle carrier.
4. Support fixed shoulder end of the bar pin.
5. Remove retaining clip and outer collar from the split ring.
6. Apply approximately 400 lb press load to the spacer and remove the split collar.
7. Remove spacer and shims.
8. Press bar pin out of bearing cones.
9. Remove outer seals from both sides of bearings.
10. Remove bearing raceways from the steering knuckle carrier. Do not damage bores.
11. Clean the remaining grease from the bearing cavity.

Installation

1. Inspect bearing raceway and seal bores in steering knuckle carrier for burrs or damage. Inspect the bar pin for burrs or damage. Remove burrs and replace damaged components.
2. Press a bearing race into each steering knuckle carrier bore until fully seated.
3. Pack a bearing cone with grease and place it onto the bar pin and seat the inner race on the shoulder.
4. Note the position and orientation of bar pin relative to the carrier. The shoulder end of the bar pin faces forward on the upper bar pin location. The shoulder end of the bar pin faces rearward on the lower bar pin location.
5. Insert the bar pin into the steering knuckle carrier until the bearing cone is seated in the raceway.
6. Turn the steering knuckle carrier over and support the shoulder end of the bar pin.
7. Pack a bearing cone with grease and place it onto the bar pin end opposite the shoulder and seat it in the raceway.
8. Place the spacer onto the bar pin and seat it against the inner raceway.
9. Apply approximately 400 lbs of press load to the spacer. Place the split collar into the groove of the bar pin and against the spacer.
10. Use a “feeler” gage to measure the gap between the split collar and shoulder of the groove in the bar pin. Record measurement.
11. Remove the load. Then remove the split collar and spacer.

12. Using the gap measurement from Step 10, place a number of shims equivalent to the gap measurement onto the bar pin against the inner raceway.
13. Place the spacer onto the bar pin.
14. Apply approximately 400 lbs of press load to the spacer such that the split collar can be inserted into the groove of the bar pin. Make sure the split collar is fully seated in the groove.
15. Remove the press load.
16. Place the outer collar around the split collar. Install the retaining clip around the split collar on the outside of the outside collar.
17. Press a seal into each seal bore until fully seated.
18. Check bearing preload by rotating the bar pin. Slight to medium drag should be felt. If too loose, add one shim. If too tight, remove one shim.
19. Fill bearing cavity with grease.
20. Install steering knuckle carrier mounting bolts in control arms. Note orientation of bar pin. Apply Loctite #271 to mounting bolt threads and tighten to **275-300 lbf·ft**. See Torque Table.

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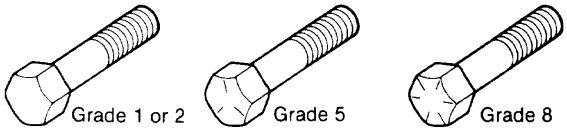
Torque Tables

Most threaded fasteners are covered by specifications that define required mechanical properties, such as tensile strength, yield strength, proof load, and hardness. These specifications are carefully considered in initial selection of fasteners for a given application. To assure continued satisfactory vehicle performance, replacement fasteners used should be of the correct strength, as well as the correct nominal diameter, thread pitch, length, and finish.



Grade Markings on Bolts

Grade	Lock Nut Grade B, F	Lock Nut: Grade C, G
Identification	3 Dots	6 Dots

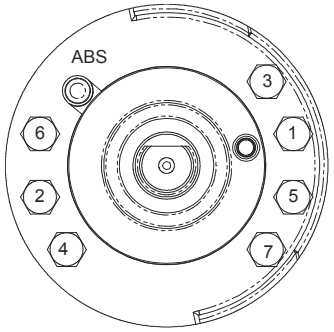
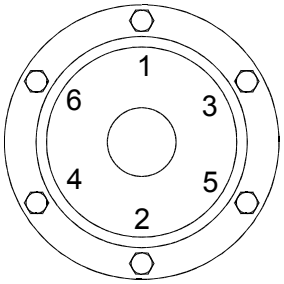
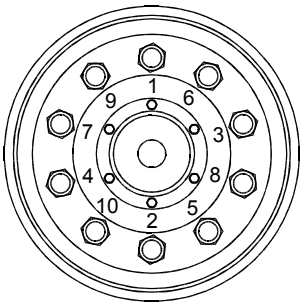
Grade Markings on Lock Nuts

Torque Table 1

APPLICATIONS	FASTENER SIZE	TORQUE SPECIFICATION (lbf·ft.) (CLEAN AND DRY)
Upper Control Arm Bushing Pivot Bolt	1-1/8-12 Grade C	950-1050[1]
Lower Control Arm Bushing Pivot Bolt	7/8-9 Grade C	460-490[1]
Eccentric Set Screw	#10-24x3/8	30-40 lbf.-in.
Steering Knuckle Carrier Mounting Bolt	3/4-10 x 2.75 Gr 8	350-370[1,4]
	3/4-10 x 2.75 Gr 9	380-410[1,4,5]
Lower Air Spring Mount Bolt (into carrier)	5/8-18 Grade 8	170-190[1,4]
Air Spring Upper Mount Bolt (into cradle)	3/8-16 x 1.75 Gr 8	20-30[1]
	3/8-16 x 2.00 Gr 8	20-30[1,5]
Air Spring Lower Mount Bolt	1/2-13 Grade 8	20-30[1]
Idler Arm, Bell Crank & Crank Arm Mount Lock Bolt	1-14 Grade 8	575-625[1]
Idler Arm & Bell Crank Ball Joint Base	M56x1.5	325-375[2]
Idler Arm & Bell Crank Ball Joint Castle Nut	M20x1.5	155-170[3]
Tie Rod Castle Nut	7/8-14	90-100
Tie Rod Clamp Nut	5/8-11 Grade B	50-60
Upper Shock Eye Mount Lock Nut	3/4-10 Grade C	170-190
Lower Shock Eye Mount Lock Nut	3/4-10 Grade C	170-190
Lower Shock Mount Bracket Bolt	3/8-16 Grade 8	30-40[1]
Steering Stop Adapter	3/4-10	85-115[2]
Steering Stop Jam Nut	1/2-20 Grade B	50-75
Steering Arm Castle Nut	1-1/8-12 Grade C	550-1025
Sway Bar Mounting Bracket Nut	7/16-14 Grade C	48-56
Sway Bar Linkage Nut	1/2-20 Grade C	75-85
Sway Bar Upper Control Arm Bracket Nut	1/2-13 Grade C	75-85
Kingpin Draw Key Nut	7/16-20 Grade G	30-45
Kingpin Cap Bolt	5/16-18 Grade 8	20-30[1]
Height Control Valve Body Mount Lock Nut	1/4-20 Grade C	10-15
Height Control Valve Linkage Stud Mount Nut	5/16-18 Grade B	8-12
Height Control Valve Adjuster Nut	1/4-20	24-28 (**lbf·in**)
Spindle Nut (IFS1660)	1-1/2-18	See Adjusting the Wheel Bearings Section
Spindle Outer Nut	1-1/2-12	200-300
Disc Brake Caliper Mount Screw	M20x2.5	300-330
Upper Crossmember Bolts	5/8-18 Grade 8	150-180[1]

1) Torque applied to bolt head.
2) Apply thread adhesive Loctite #242 or equivalent to threads of fastener threaded into tapped hole.
3) Install cotter pin after tightening.
4) Apply thread adhesive Loctite #271 or equivalent to threads of fastener threaded into tapped hole.
5) Used with IFS1800FT units.

Torque Table 2

APPLICATIONS	FASTENER SIZE	TORQUE SPEC. (lbf·ft.) (CLEAN AND DRY)	TORQUE SEQUENCE
IFS1660/1800FT Brake Spider and Torque Plate Mount Capscrews 3/4-16 Grade 8 290-320			 Driver Side
Hub Cap Bolt	5/16-18 Grade 5	20-30(1)	
Wheel Nut	M22x1.5 (Hub Piloted)	450-500(2) (Dry Threads)	

1) Torque applied to bolt head
2) Recheck wheel nut torque after first 50-100 miles.